THE FOUNDRY

Volume 53
Number 13

CLEVELAND, OHIO, JULY 1, 1925

Published
Semimonthly

Castings Used in Machines for Harvesting Crops

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In July, Thousands of Reapers and Binders, Made Chiefly of Cast Parts, Cut the Grain Crop of the Country

Find Where Castings Can Be Sold

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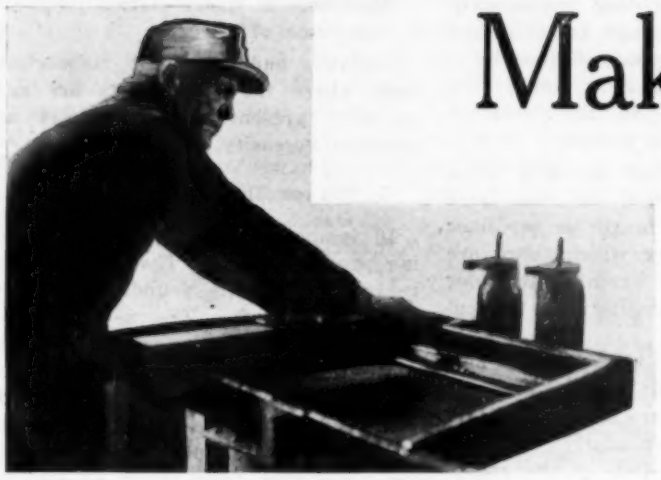
Making Patterns a Business Asset



Johnny McCann dolls up each pattern for the next days heat

By E. H. Trick

NOT all managers of firms doing a general jobbing foundry business realize the full value of the varigated stock of patterns accumulated over the years.

These patterns have a two-fold value to a firm doing all sorts of foundry and machine work. The first is directly related value for their contribution to the original order. Their secondary potential value lies in their possible adaptation to other than their original uses. Those wooden and metal patterns that most often lend themselves to the last mentioned service are gear wheels, pulleys, sprocket wheels, fly wheels, grate bars, bearings and stands and similar specialties. The first, direct value is easily computed; but no one can state with accuracy the potential value of a wide range of stock patterns.

What percentage of jobs are booked only because the patterns are extant, or because the bidder has in his possession patterns that can be adapted to the work at a small expense for alterations?

Often whole contracts are booked because of the difference in bids afforded by the existence of patterns that have not been used for years. The writer had an experience several years ago where a single pattern of an engine cylinder, that had laid tucked away on an obscure shelf for years, reduced the bid on a good sized contract sufficiently to secure the business. Patterns that are well made should last for years and they should not be put aside and neglected because there appears to be no immediate need for them. The least of them should be considered potential wealth. Some of the older firms that have grown from small beginnings and have gathered together a vast assortment of stock patterns are slow to realize the great possibilities of that stock. They do not seem to be aware that patterns are susceptible of the same tangible results as good machinery, buildings or other easily recognized assets. A narrow escape from some calamity often is required to bring the idea home. A flood, a fire, a disaster to someone near by often is necessary to the realization of what their predicament would be if the pattern stock suddenly were wiped out. Happily, in our own case, a reason less radical in its nature dictated a wise and purposeful policy.

Revamp the System

An entire reorganization of the gray iron end of the business by the Alamo Iron Works, San Antonio, Tex., made imperative extensive enlargement of the pattern storage space and a reconsideration of pattern handling facilities. Ever since the establishment of the business in 1878, until a few years ago the growth of the business was slow but steady. As the demand for more pattern space presented itself, dark corners were cleared out and the patterns of articles rarely needed were placed therein. This created room in the regular pattern storage loft for the increasing stock of new patterns and coreboxes. When the reorganization was effected and the foundry put on a real production basis under the foremanship of a thoroughly competent foundryman, the business expanded so rapidly that the demand for proper pattern handling became insistent. To meet this demand, the

EDGAR H. TRICK, who wrote this article has had a varied foundry career. He was in the drafting room of S. V. Huber & Co., Pittsburgh for a number of years and later was with the engineering department of the Carnegie Steel Co. until 1905.

NEXT he was on gas engine design and was an estimator for the Union Foundry & Machine Co., for about eight years. All of this time, he was just working around the borders of the foundry industry, you see.

THEN in 1915, he plunged in with the Alamo Iron Works, San Antonio, Tex. and made things hum while he was passed along through the jobs of mechanical engineer, estimator and supervisor. For the past four years he has been superintendent of that plant.

company erected a splendid pattern storage building consisting of five stories and basement, of reinforced concrete and hollow tile. This building is as near fireproof as ingenuity and tested engineering practice could devise. Each floor is a separate unit and has no internal connection with any other. Stairways and elevators are outside the building. Windows are made of heavy wire glass set in steel frames. Electric wires are run

in standard conduit. Doorways are covered with underwriters standard fireproof doors. Chemical, fire extinguishers are provided, readily accessible inside the doors and standard fire hose connections are placed outside the doors.

All interior walls, ceilings and columns are painted white, as are the broad racks on which the patterns themselves are placed. Since the building abuts private property there are no windows on that side but with the exception of the aisles adjacent thereto there is sufficient natural light throughout all the floors to permit the pattern rustler to find any pattern for which he may be looking.

Convenience Governs

The patterns are arranged by floors and by racks with consideration both for the patterns themselves and convenience for frequent service. For instance, the heavy, water-works patterns and coreboxes are kept in the basement of the building, where the temperature is most nearly uniform. The column patterns are kept on the first floor for being long and ungainly they are more easily handled there. The patternshop is on the second floor of the building immediately adjacent to the storage building and is connected to the second floor by a walkway. On that floor are stored a large majority of the patterns that are in constant service.

Those patterns that are less often called for are stored on the third floor, while on the fourth or top floor are stored those for which there are infrequent calls. From this floor they emerge as kindling for the cupola.

Wood patterns, no matter how carefully made, are hard to preserve over a period of years, in any climate; but they are particularly hard to maintain in the uplands of the southwest. San Antonio occupies a position geographically unique. Although only 150 miles from the Gulf of Mexico and possessing an elevation of but 725 feet above that water, the climate is so tempered by proximity to the high plateau on the west that for long months at a stretch the dryness of the air approaches downright aridity. However, when it rains the atmosphere immediately drings up the moisture to the saturation point and imparts it to anything that will absorb it. Doors stick to their jambs,

All patterns entering and leaving the foundry must pass through the door where Johnny is in charge—After use, the patterns are stored in dry, fireproof vaults, in which even the shelves are painted white.

windows cannot be raised, metallic objects drip cold sweat and wooden patterns get all that is coming to them. The absorbed dampness softens the glue, the wood swells and bulges, concealed strains manifest themselves and when the pattern dries out again it fairly pulls itself into many pieces.

Right here is where eternal vigilance is the price of safety.

Careful and constant inspection finds where the weak spots are and an ever present shellac pot is an absolute necessity.

Hit or Miss—Mostly Miss

In many jobbing shops the following procedure rules: The patterns are returned from the foundry direct to the pattern loft. The necessity for repairs or renewals is not noticed until the patterns are brought out for their next service in the foundry. Then the time for attending to such matters is cut short owing to the usual rush from which all jobbing work suffers. Repairs are only half made or the necessity for them temporarily ignored altogether and the *buck* is passed to the molder, who must get good molds by some *hokus pokus* or pull down an ugly percentage of bad castings on his monthly production record.

Often, in the rush of many things he must look after, the foundry foreman does not notice the condition of every pattern coming into the foundry and much valuable time is lost patching bad holes. So little spells the difference between a good, workable pattern, and a bad pattern. A molder hesitates to point out defects in the pattern equipment to the foreman lest the latter come to regard him as a chronic knocker or suspect that he wants things to come too easy to him. The writer has known men of foreign birth and no training continually to refrain from telling their foreman of defective equipment under the impression that they would in-

cur his displeasure by complaining That is a perfectly natural attitude for ignorant minds to take, as they are unable to comprehend that criticism ever can be other than destructive.

No foundry will ever show maximum profits whose management depends on getting accurate knowledge of the condition of the equipment from the men doing the work. It means nothing in the young life of the average molder that he lose 20 minutes patching up a messy draw.

Take Preventive Measures

The foundry at the Alamo Iron Works is provided with a first aid dispensary for sick patterns. This is a small room, located alongside the main entrance and is equipped to render first aid to disabled patterns and coreboxes. The equipment consists of a stout work bench about 6 feet long and a full line of tools and supplies necessary to make minor repairs on the general run of wood patterns found in the ordinary job shop. These include a hand saw, a claw hammer, chisels, gages, pliers, sand paper, rule, pot of clear shellac, a pot of black shellac, cold glue, an assortment of patternmakers nails and brads, a few leather fillets of assorted sizes, etc.

The room contains two sets of broad shelves; one set for patterns going into the foundry and one for patterns going out into storage.

The fireproof, pattern storage building already described is located a considerable distance from the foundry, entirely beyond the zone of cupola sparks. The pattern rustler brings the patterns from this building and delivers them to the repair room, and places them on the shelves provided for ingoing work. The man in charge of the repair room gives them the *once over*. His trained eye instantly detects the superficial defects that used patterns develop such as slivering, loose fillets, swells, roughness due to the opening of the pores of the lumber, shrinkage distortions, under drafts, etc. If he can repair them with the equipment he possesses in a reasonable length of time, he does so. If the defect is of such a nature that the services of a patternmaker is required, he immediately rushes the pattern to the pattern-shop. After it has been repaired it again is delivered to the shelf for ingoing work with the number of castings wanted marked on it with common white chalk.

As the molders complete their jobs on the floor, at the machines or benches, they report to their foreman who always has a job scheduled ahead for each man. The patterns of the jobs that have been completed are returned to the shelves of the repair room, obvious defects are repaired by the man in charge and they are returned at once to the regular pattern storage building.

He Follows Through

In the afternoon, just before the heat is poured, the repair man follows up the man who checks up production and gathers up all the patterns that can be stored readily in the repair room. The large ones from which castings are to be made in several successive heats and which on account of their size cannot readily be removed to the repair room, are taken to a space reserved for them in a corner of the foundry. The repair man brings his sand paper, shellac or whatever may be necessary and does his retouching of them there in the open. Those that have been removed to the repair room are then prepared for the next day's use, marked plainly with figures indicating the number yet to be made off them and placed on the proper shelves. From them the foundry-foreman can select jobs for the different molders as necessity requires.

Remember 'way back when—?

The maintenance of this repair room has proven a money saver. Patching a mold in the foundry is a rare thing when such a plan is worked conscientiously. A single coat of shellac on a pattern may mean the saving of as much as 20 minutes of a molder's time by insuring a satisfactory draw. The foundry-foreman might well adopt the present day slogan of the sellers of paint, *Save the surface and you save all.*

A pattern that is slick and clean and generally in good condition keeps a molder pleased, lightens his work and sees him through the day without harassing, annoying losses of time and patience.

It is mighty satisfactory for a superintendent to pass through the foundry department just before pouring time and see the men cheerful and contented even though tired by the day's effort. Every influence that contributes to that end should be fostered with jealous care and good patterns always in good condition for use are a heavy factor contributing to that end.

Care must be exercised in the selection of the man to be put in charge of the repair room. A man handy with tools and preferably with some experience in foundry work, as molder or even as a helper, is preferable. If he has had a dab at the carpenter trade or at wood working of any kind, so much the better. He must be quick, willing and industrious, for in the hurly burly of the average day in a jobbing foundry, the man with lead in his shoes soon wins for himself a comfortable seat on the toboggan.

Foundrymen Offer Prize

The American Foundrymen's association has organized a competition for foundry workers for the Syracuse meeting which is to be held Oct. 5 to 9. This competition provides for a prize, known as the S. Obermayer Award, and will be given to the foundryman who submits the best idea for a foundry jig or a device which may be used for the purpose of increasing the production of castings or facilitating the handling of equipment. Any jig, piece of equipment, or description of a method that may be used in molding, making castings, or in handling operations, will be acceptable.

A condition is that entries must be in the hands of the judges 30 days in advance of the convention date. Those wishing to compete should, as soon as possible, inform the secretary of the American Foundrymen's association, 140 South Dearborn street, Chicago. This competition is made possible by a fund contributed in 1920 by the S. Obermayer Co., Chicago.

American Rights Taken

The American rights under the Bosshardt patents, recently acquired by Ellis Miller and associates, have been vested in the American Bosshardt Furnace Corp., 347 Madison avenue, New York. The president of the corporation is Andrew M. Hunt, Peyton & Hunt, New York. Edgar Baruc, Bernhard, Schiffer & Co. is treasurer. The technical direction will be in the hands of Walter J. Wjllis, recently in charge of the steel and malleable iron production of the Gould Coupler Co., Depew, N. Y. Mr. Willis is now vice president of the American Bosshardt Furnace Corp. The furnaces are operated with ordinary bituminous coal, gasified in small generating chambers forming part of the furnace.

The Philadelphia office of Pilling & Co., Inc., has been removed to Franklin Trust building, 1500 Chestnut street.

Brings Old Plant Up to Date

Introduction of Molding Machines, Sand Cutters and Monorails Materially Improved Production Methods in a Shop Devoted to Manufacture of Heaters

By Pat Dwyer

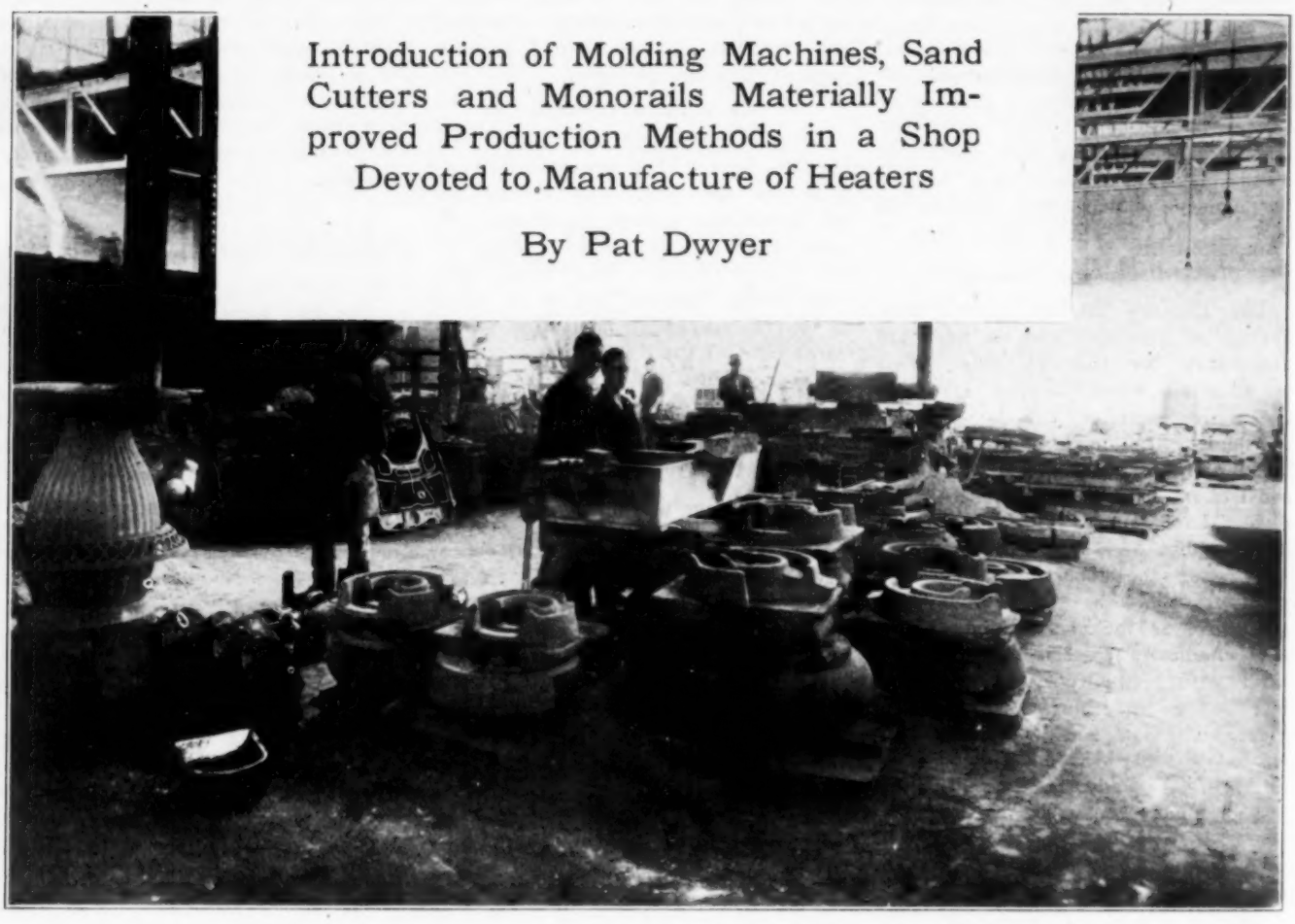


Fig. 1—The core room is exceptionally well lighted through a saw tooth roof

ADJUSTMENT in several features of shop practice were made to conform to an improved system of numbering patterns and maintaining a perpetual inventory at the plant of the Richardson & Boynton Co., Dover, N. J., described in the June 15 issue of THE FOUNDRY. Equipment was installed and methods placed in force without retarding operation or curtailing production at a time when the various shops were filled to normal capacity with work. Some of this equipment replaced items worn out in service or obsolete. Other pieces of equipment were adopted to meet changing industrial conditions. The plant was built and placed in operation at a time when labor was cheap and plentiful, when molders cut over their own sand, when castings were trucked in wheelbarrows from one part of the plant to another and where the castings were not entirely cleared from the gangways before noon.

These features and others have undergone a radical change in recent years. Labor no longer is either cheap or plentiful. In many cases mechanical equipment has passed the stage of being a convenience and now is an actual necessity. This applies both to handling the raw material in the yard and handling the sand, molten iron and castings in the building. A brief description of the general layout of the group of buildings comprising the plant greatly will facilitate subsequent description of the method of operation.

Shop In Three Main Sections

Railroad facilities for incoming and outgoing freight are supplied by the Central Railroad of New Jersey and the Delaware, Lackawanna & Western railroad. An extensive series of standard gage tracks is spread over the yard and a locomotive crane made by the McMyler-Interstate Co., Cleveland is used in its legitimate capacity as a loader and unloader and also as a shunter in spotting freight cars at any desired point on the tracks.

Iron and coke are unloaded in a long yard that parallels the entire length of the foundry building on one side. Sand is unloaded into a shed recently erected a short distance outside the end of the building. The shed is divided into several compartments and each compartment is provided with a wood cover fitted with suitable hooks at the corners so that it may be handled by the locomotive crane. Steel I-beams laid flat on top of the dividing walls support the covers at a slight angle to shed the rain. A projecting member on the lower side of the cover fits in the hollow formed by the web of the I-beam and in effect forms a sealed joint. Any water that falls between adjoining covers drains into the hollow of the beam and is conducted to the eaves of the building. This feature is illustrated in Fig. 5.

The foundry is divided into three main sections according to the character of the castings. Fire pots are made at one end. All the remaining component parts of steam and hot water boilers are made in the central part and stoves are made at the other end.

A separate cupola is operated to

serve each division with iron. The cupolas are located on the side of the building nearest the stockyard and are served in the usual manner with an individual elevator and charging cars for each unit. One cupola, 66 inches inside the lining, is located a short distance from one end of the building. The second cupola, 78 inches inside diameter, is set up approximately half way from one end to the other end. The third cupola, 66 inches inside the lining, serves the stoveplate section of the foundry and is located about 50 feet from the end in that section of the building. All three cupolas were supplied by the Whiting Corp., Harvey, Ill.

Use Coal Fired Ovens

A space, 50 feet in length and almost the entire width of the building between the boiler and range making departments, is set apart for a coreroom. The ovens are fired with anthracite coal and present no unusual features. Small green cores are loaded on racks and the entire load is carried into and out of the oven on a lift truck. Large cores are loaded on cars. The cores are made entirely from sharp sand bonded with a proprietary liquid binder. In this connection it is interesting to note a curious feature that developed in the core room practice in this foundry. Formerly the sand was secured from a salt water beach and while apparently the cores were satisfactory, occasional defective castings caused an investigation. The trouble finally was traced to an obscure cause.

After testing the cores under a variety of conditions where contradictory results constantly prevented a solution of the problem, the theory finally suggested itself that perhaps the salt in the sand attracted sufficient moisture to cause trouble when the core was left in the mold for a considerable time. At the time the theory seemed far fetched, but a change in the composition of the core mixture justified its accuracy. Sharp sand from a bank deposit was substituted for the beach sand and the trouble disappeared.

A small section of the floor in the vicinity of the coreroom is reserved for making white metal and brass patterns. The metal is melted in three, coke-fired, natural draft crucible pit furnaces located close to the wall where they occupy comparatively little valuable floor space.

FIG. 3—THE SAME GANGWAY SHOWN IN FIG. 2 AFTER IT HAS BEEN CLEANED

FIG. 2—THIS VIEW SHOWS THE CONDITION OF THE GANGWAYS IMMEDIATELY AFTER THE CASTINGS ARE SHAKEN OUT

Even under ordinary conditions, pattern replacement and refitting represents quite an item in the operation cost of the foundry. Recently this item loomed larger than usual on account of changes in the method adopted for making many of the molds on power-operated machines. This feature will be taken up more in detail later. The pattern shop, shown in the preceding article, is fitted up with all the necessary tools and appliances to prepare wood and metal patterns and to fit them to flasks and pattern plates for use either on the floor or in conjunction with molding machines.

Castings are cleaned in a long building separated from the foundry building by an alley on the opposite side to the stockyard. The entire plant is laid out and operated on a plan that constantly keeps the product moving toward the shipping room. The small castings are cleaned in a battery of tumbling barrels made by the W. W. Sly Mfg. Co., Cleveland. Large castings are sandblasted in three units made by the same interest and in a single installation made by the American Foundry Equipment Co., New Yorp.

Taken To Other Rooms

From the cleaning room, the castings are taken to an adjoining room where they are chipped and where the boiler sections are tapped and threaded and afterward tested under water pressure. Finished castings of all descriptions are taken first to a stockroom where they are checked, classified and stored. From the stockroom they are taken to other departments. A certain proportion is taken directly to the shipping room. Part of the

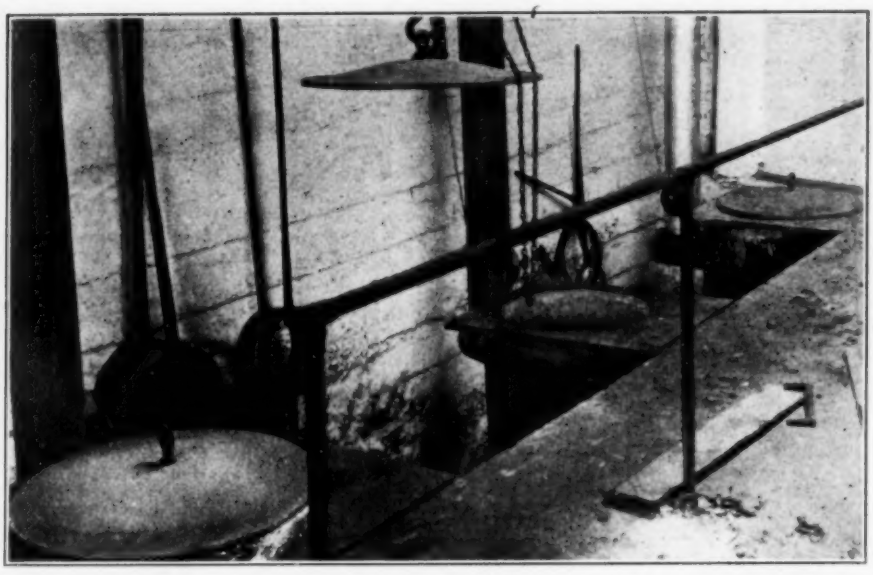


FIG. 4—NONFERROUS METAL FOR PATTERNS IS MELTED IN A BATTERY OF THREE HOME MADE FURNACES LOCATED IN A PIT THAT IS PROTECTED BY A HAND RAIL

remainder is taken to the enameling department where the surface of the casting is finished either gray or white. The wet process is used exclusively. The material is sprayed on the face of the casting by a pneumatic device and the uniformity and thickness of the deposit is governed by the skill of the operator.

Other castings pass through a room where minor machining operations are performed. They are drilled, tapped, threaded, fitted with lids, handles, knobs and other accessory parts. A plating room is maintained in one section of the building. Outer casings for the furnaces and many other parts made from tin and sheet metal are fabricated on the second story of the building which houses all the foregoing finishing departments.

Any description of the plant would be inadequate without reference to an artesian well which supplies all the water required for drinking and industrial purposes. An elevated steel water tank meets all the requirements of the fire fighting apparatus. The plant is located on the outskirts of the town of Dover and this local water supply renders it independent in many respects.

At the time the Brooklyn shops were abandoned in favor of the new plant at Dover the executives believed they could attract and hold a better working force than the more or less unsatisfactory and transient workmen available in a large city. How well their faith has been justified is reflected in the statement that a great number of the men have been employed constantly since the plant started. Out of a total enrollment of nearly 1000 men, the labor turnover for the year is less than 10 per cent.

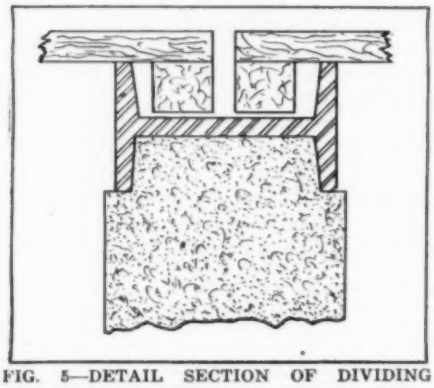


FIG. 5—DETAIL SECTION OF DIVIDING WALL, STEEL BEAM AND WOOD COVER IN THE SAND SHED

Hot and cold water in showers and basins is provided in an extensive locker room where the employes change on their way to and from work. A first aid department in charge of a registered nurse is maintained in close proximity to the locker room where employes are treated locally and immediately for accidents or minor ailments. It is claimed that precautionary and preventive measures applied in this department yield direct returns both to the men and the company. The men profit from uninterrupted employment and the company profits from steady production.

A monorail system extends over the various gangways in the foundry and serves to convey flasks, sands, cores and metal from place to place. Extensions from the main line enter the cleaning room and facilitate the removal of castings from one department to another. Most of the small castings are loaded in steel boxes made by the Truscon Steel Co., Youngstown, O., and transported from place to place by lift trucks as shown in the illustration, Fig. 6. The boxes are mounted on skids and readily may be picked up or deposited. Large castings are suspended from the monorail by hooks and cores are conveyed on trays.

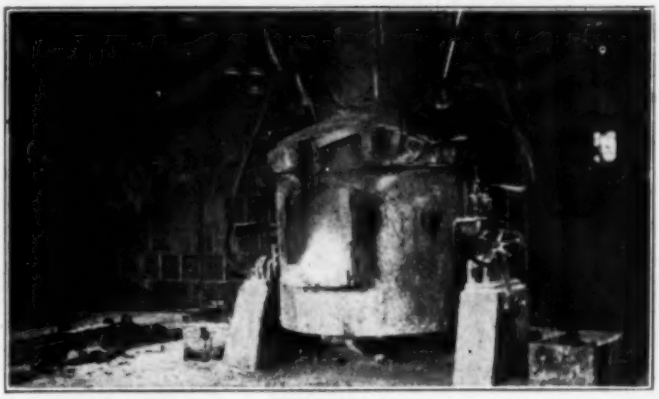
Formerly the castings were shaken out in the afternoon and piled in the gangway, there to remain until the following morning when the work of removing them to the cleaning room commenced. Approximately 120 tons of iron is melted daily and this results in about 75 tons of good castings with the remainder represented by gates, sprues and scrap. The castings are sent in one direction toward the cleaning room and the scrap is sent in the opposite direction toward the

(*Concluded on Page* 521)

FIG. 6—THE MONORAIL SYSTEM FOR CONVEYING CASTINGS FROM PLACE TO PLACE IS SUPPLEMENTED BY LIFT TRUCKS

Making Cast Stainless Steel

Corrosion Resistant Metal May Be Made Economically in an Electric Furnace



Slag Control Is of Greatest Importance To Success—Detail Costs Are Given

By J. M. Quinn

Fig. 1—A 500-pound experimental electric furnace making a heat of stainless steel—Note the side electrodes

STAINLESS steel containing about 0.30 per cent carbon and 13.00 per cent chromium is being used more extensively as its desirable properties are appreciated. In making stainless steel more than ordinary metallurgical skill is required to produce a product which is uniform in chemical and physical properties. Consumers are quick to note differences in stainless steel of the same analysis made by different manufacturers. Considering the difficulties encountered both in making this steel and in pouring the metal into sand molds, few have attempted making castings from such a metal.

The author formerly was connected with a company which produced many heats of stainless steel for castings, first experimentally, then on a production basis. Glass molds, golf heads, tools and other castings were made, ranging in weight from a few ounces up to 50 pounds. Because of the excessive shrinkage of this metal, difficulty was experienced at first in producing sound castings, but this was overcome by using larger risers and chills on the heavy sections.

The experimental 500-pound capacity, electric furnace used is shown in Fig. 1. Although two electrodes entered the furnace at a position similar to the Webb electric furnace, they were adjustable so that an equilateral triangle was formed with the third or vertical electrode when arching to the bath, giving a condition similar to the furnace made by the Pittsburgh Electric Furnace Corp., Pittsburgh. The electrodes were hand controlled and were harder to operate than the automatic control type. The bottom and walls were lined with magnesite to the roof, except for the door jamb and door arch which were built of carborundum and alundum brick. The roof was made entirely of alundum brick. All repairs to the bottom between heats were made with finely ground magnesite and diluted sodium silicate or water glass. This is a satisfactory patching material for small electric furnaces, as it will stand high temperatures. The shape of hearth may be maintained easily and the material sets quickly at either high or low furnace temperatures.

The first experimental heat of stainless steel produced in this furnace was made from scrap metal which consisted of heavy boiler plate punchings low in carbon, manganese and under 0.05 per cent phosphorus and sulphur. The specification for this heat called for the following:

	Per cent
Carbon	0.25 to 0.35
Manganese	0.40 to 0.50
Silicon not over	0.40
Chromium	12.00 to 14.00
Phosphorus not over	0.30
Sulphur not over	0.03

Starting The Heat

As this scrap was more or less oxidized, it was charged into the hot furnace and the latter was operated for a few minutes to obtain good arcing conditions. A large amount of burnt lime was added which steadied the fluctuations of the arc. The melting down period was exceptionally long on account of the punchings welding together. This was caused by the low carbon content and their clinging high on the furnace hearth. When the charge was all melted, the slag was thin, indicating a large amount of iron and manganese oxide in the slag. Therefore, additional burnt lime was added which further reduced the phosphorus in the steel.

As the fractured test piece indicated that the carbon was extremely low, the oxidizing slag was removed from the furnace. Then burnt lime was added and when the slag was fluid, additions of bituminous coal, lime and spar, well mixed, were made. This caused the slag to foam, showing that the coal was reducing the oxides in the slag. Tests taken during this period showed the slag a dark brown, gray and finally nearly white. All of these disintegrated when cool. Carbon-free ferrochromium was then added to the bath as fast as it seemed possible, but at times the amount was so large that the slag was partly frozen and held up a quantity of this ferrochromium. When this ferrochromium was pushed near the electrodes, some of the chromium was volatilized by the high temperature of the arc. Calculating from the final analysis and metal weights, this loss was 18 per cent which is much higher than the practice on subsequent heats.

After the chromium was melted, the slag was thin and dark green in color. Consequently, additions of mixed coal, lime and a small amount of powdered silicon were made. In a short time the slag was light green, but did not disintegrate to a powder. Further additions of this mix were made until the slag was practically white with a light greenish tint which disintegrated when cool. The color of the slag indicated that the chromium had been reduced to the metal so a test was taken for carbon, manganese and chromium to be sure that the various elements would be within the specification. At this time the metal was hot and when poured into test molds, showed solid steel but with excessive shrinkage.

While waiting for the laboratory report, the slag turned to a darker green. Therefore, lime mixed with a

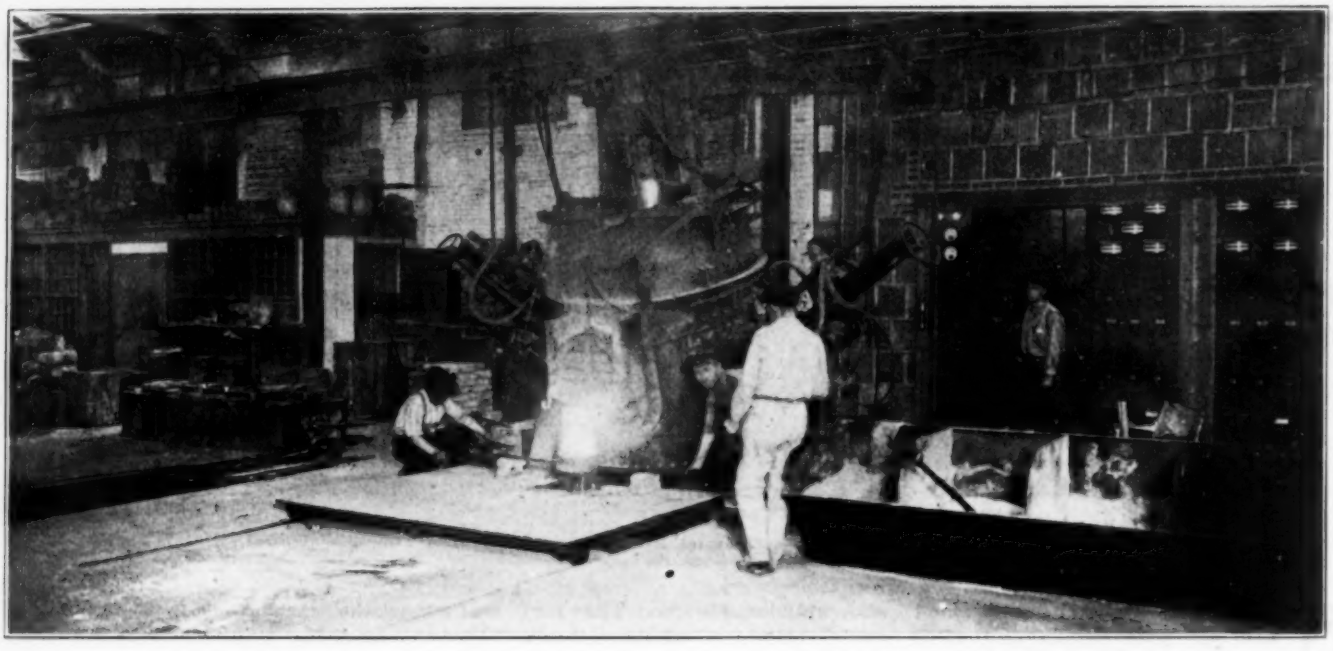


Fig. 2—Pouring molds with stainless steel from an electric furnace

small amount of coal was added from time to time, to keep the slag light in color. Coal was used sparingly to prevent the metal picking up carbon from the slag. The laboratory reported carbon 0.24 per cent, manganese 0.40 per cent and chromium 13.32 per cent. No further additions of alloys being necessary, part of the slag was removed from the furnace as all the metal was to be poured into 100-pound bull ladles and there had to be sufficient metal in each ladle to pour the castings required in this particular case.

After removing the small amount of slag from the metal in the bull ladles, the steel was still hot. It was held for a few minutes until a film formed on the surface and then poured over the lip into the molds. The final analysis of the steel was: Carbon, 0.25; manganese, 0.45; silicon, 0.38; chromium, 13.30; phosphorus, 0.032; sulphur 0.025 per cent.

The castings were placed in an oil-fired annealing furnace and brought from room temperature to 1400 degrees Fahr. in 3 hours and 15 minutes, then held between 1400 and 1430 degrees Fahr. for 7 hours and allowed to cool slowly until the temperature was below 900 degrees Fahr. Annealed

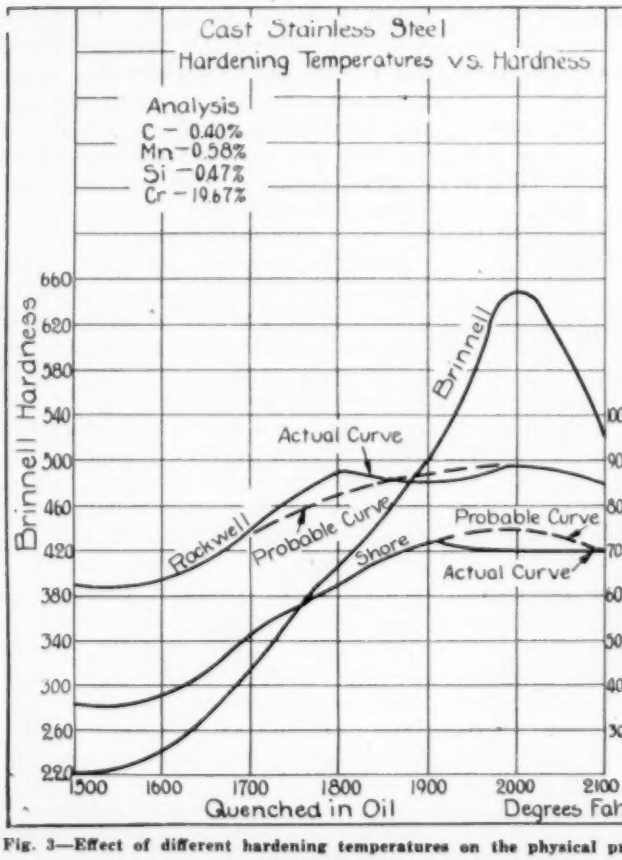


Fig. 3—Effect of different hardening temperatures on the physical properties of a nineteen per cent chromium steel.

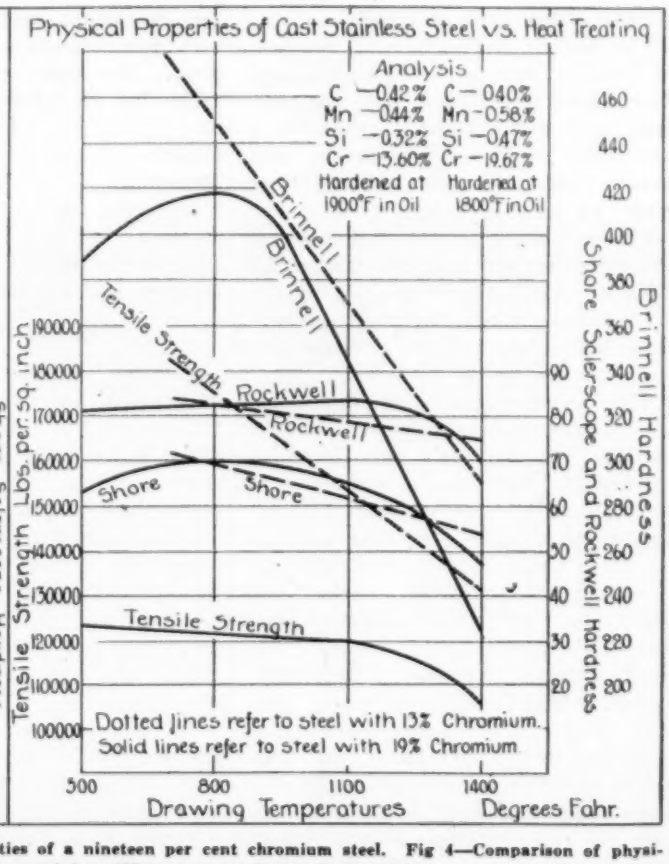


Fig. 4—Comparison of physical results obtained on two samples of steel containing different proportions of chromium

test piece gave the following physical properties.

Tensile strength, pounds per square inch	97,925
Elastic limit, pounds per square inch	70,000
Elongation in 2 inches, per cent	18.75
Reduction in area, per cent	38.00
Scleroscope hardness	30
Brinnell hardness	217

The annealed castings machined well in the lathes and milling machines, permitting light finishing cuts. Greater softness could have been secured by annealing this steel above its critical temperature which is about 1550 degrees Fahr. but machining would have been difficult. Experience has shown that stainless steel of extreme softness tends to drag and tear when light cuts are made with a cutting tool, leaving a surface which requires considerable grinding to finish properly. However, if this steel is annealed again at a temperature below the critical range, about 1400 degrees Fahr., the machining properties are improved greatly.

Using Returns

Another experimental heat in this series was made utilizing gates, risers and bad castings from previous stainless steel heats which were cleaned of adhering sand. The 230 pounds of stainless steel scrap first was charged in the hot electric furnace, followed by 230 pounds of Swedish iron which has also been cleaned thoroughly by tumbling. After the power had been on five minutes, 40 pounds of burnt lime low in silica, was added which practically covered the scrap metal. At the end of 40 minutes, the charge all was melted, but the amount of slag was not sufficient, and 20 pounds of lime was added. Ten minutes later, observation showed the slag black and thick, therefore 3 pounds of fluor spar was added to thin the slag. When the slag was the proper consistency, 2 pounds of crushed silicon, coal and lime was spread over the bath to start reducing conditions. After 5 minutes, the slag still being black, coal, lime and 4 ounces of aluminum shot were added, followed in another 10 minutes by coal, lime and 8 ounces of aluminum. As the slag still was black, coal, lime, 8 ounces aluminum and 1 pound of ferrosilicon were thrown on the slag. In 5 minutes the slag was forming and had turned to a greenish white. A metal test at this time showed the steel not deoxidized. The object of the silicon and aluminum additions was to reduce the chromic oxide in the slag to chromium, so it would pass into the metal. The efficiency of this reduction was excellent. There was less than ½ of one per cent loss of chromium.

Fifteen minutes after the first metal test, the steel was in good condition and a sample was sent to the laboratory for carbon determination. During the 30 minutes while waiting to hear from this test, the slag was kept light in color by coal and lime additions. Coal was used sparingly at all times, so the metal would not pick up carbon from this source. The preliminary carbon was reported 0.17 per cent and 64 pounds low carbon ferrochromium was added immediately. As the slag turned to a dark green, this was changed to a light green by a mixture of coal, lime and 8 ounces of aluminum. In 20 minutes the metal test was good and a sample was sent to the laboratory for carbon, manganese and chromium determination. The slag was kept in the proper condition by small additions of slag mixes. The temperature of the metal gradually was increased until the maximum temperature was obtained shortly before the chemist reported the results. These determinations had taken 40 minutes and were carbon 0.28, manganese 0.46, chromium 13.65 per cent.

Works On Decline

The temperature of the metal in the bath gradually was reduced as all reactions of deoxidation are exothermic and consequently could be completed when the components were in a condition of lowering their temperatures. This is why it is essential to have the maximum temperature of the steel at the start of final deoxidation in the furnace, but not at the time of tapping. At too high a temperature or on its rise, the steel cannot be killed completely even in the presence of an excess of deoxidizing mediums, because there will be an equilibrium between the gases or oxides in the steel and the deoxidizers. Consequently, when cooling starts, the reactions will be completed readily as the drop from the high temperature represents the best condition for all exothermic reactions. All of the deoxidation must proceed in the furnace, for when the steel is in the ladle, the cooling is too rapid and the steel will be solidified before the completion of reactions and the resulting castings will be inferior in quality.

As a test at this time showed the steel to be in excellent condition, this metal was poured directly into the bull ladles. After removing the small amount of slag from the ladles, the steel was held until the film formed was heavy in appearance and the metal still was hot enough to pour without forming any skulls by the time the ladles were empty. The castings were good, with risers piped deep.

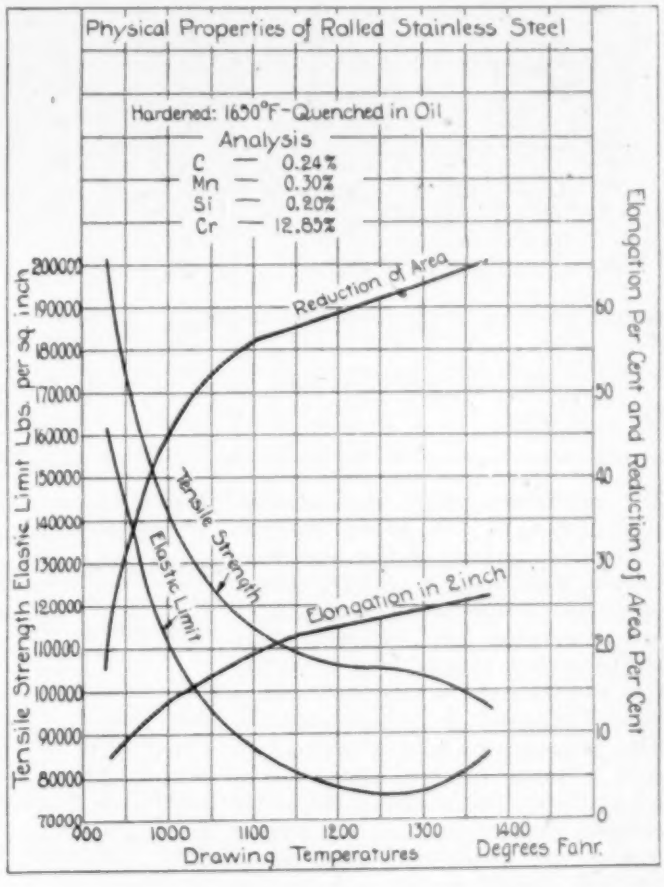


Fig 5—Physical effects of hardening quenching and drawing a 12.85 per cent chromium steel

Metal and Alloy Costs of Stainless Steel

Commodity		Amount Used Pounds	Unit Price	Total Value	Cost Per Pound
	13 Per Cent Stainless Steel				
Scrap	0.10 Per cent carbon	777	0.015	$11.66	
65 Per cent Ferrochromium	1.00 Per cent carbon	208	0.22	45.76	
50 Per cent Ferrosilicon		9	0.05	0.45	
Aluminum		6	0.30	1.80	
Carbon in bath	0.10 Per cent				
Carbon in ferrochrome	0.19 Per cent	1000		$59.67	$0.060
Final Carbon	0.29 Per cent				
Final Chromium	13.52 Per cent				
	16 Per cent Stainless Steel				
Scrap	0.10 Per cent carbon	731	0.015	$10.97	
65 Per cent Ferrochromium	1.00 Per cent carbon	200	0.22	44.00	
65 Per cent Ferrochromium	0.30 Per cent carbon	54	0.33	17.82	
50 Per cent Ferrosilicon		9	0.05	0.45	
Aluminum		6	0.30	1.80	
Carbon in bath	0.10 Per cent				
Carbon in ferrochrome	0.19 Per cent	1000		$75.04	$0.075
Final Carbon	0.29 Per cent				
Final Chromium	16.51 Per cent				
	19 Per cent Stainless Steel				
Scrap	0.10 Per cent carbon	685	0.015	$10.28	
65 Per cent Ferrochromium	1.00 Per cent carbon	170	0.22	41.80	
65 Per cent Ferrochromium	0.30 Per cent carbon	130	0.33	42.90	
50 Per cent Ferrosilicon		9	0.05	0.45	
Aluminum		6	0.30	1.80	
Carbon in bath	0.10 Per cent				
Carbon in chromium	0.18 Per cent	1000		$97.23	$0.047
Final Carbon	0.28 Per cent				
Final Chromium	19.50 Per cent				

Estimate based on:—

Total metal and alloy charge of 1000 pounds.
Selected low phosphorus and sulphur scrap at $30.00 per net ton.
65 Per cent ferrochromium containing 0.30 per cent carbon at $0.33 per pound ferroalloy.
65 Per cent ferrochromium containing 1.00 per cent carbon at $0.22 per pound ferroalloy.
50 Per cent ferrosilicon at $0.05 per pound ferroalloy.
99 Per cent aluminum at $0.30 per pound.
Chromium calculate on high side of specification as no metal or alloy losses are taken into consideration.

Per cent Carbon	Per cent Manganese	Per cent Silicon	Per cent Phosphorus	Per cent Sulphur	Per cent Chromium
0.25	0.40	0.40	0.030	0.030	As Shown
0.35	0.50	0.00	0.000	0.000	Above

The molds were made of sand with chill plates on the heavy sections.

The final analysis of this heat was: Carbon, 0.42; manganese, 0.44; chromium, 13.60; silicon, 0.32; sulphur, 0.21; and phosphorus, 0.017 per cent. Part of the carbon pick-up came from the coal additions to the slag as the steel was being heated for final deoxidation. This is extremely hard to prevent in such a small furnace when making a metal which has a strong affinity for carbon. However, most of the sudden increase in carbon and also silicon probably came from the carborundum brick used in the door arch melting and contaminating the metal. Carborundum brick were selected as an ideal brick for an electric furnace door arch because of their high dissociation point which is over 4000 degrees Fahr., their density, high heat conductivity and freedom from spalling. However, it has been found that vapors of FeO, CaO, MgO, MnO and other oxides reduce the 4025 degree Fahr. dissociation temperature to approximately 2200 degrees Fahr. It can readily be appreciated that when even a small amount of a commodity containing 65 per cent silicon and about 30 per cent carbon, comes in contact with a small quantity of metal and slag, the metallurgical reactions are affected materially.

When annealed this steel had slightly better physical properties than the first heat, as is shown from the following tabulation:

Tensile strength, pounds per square inch	115,500
Elastic limit, pounds per square inch	90,000
Elongation in 2 inches, per cent	20.3
Reduction in area, per cent	44.0
Scleroscope hardness	45
Brinnell hardness	228

Annealed test pieces of this steel were heated to 1900 degrees Fahr. and quenched in oil, then reheated to 1400 degrees Fahr. and air cooled, giving additional physical data as follows:

Tensile strength, pounds per square inch	141,500
Elastic limit, pounds per square inch	112,500
Elongation in 2 inches, per cent	12.5
Reduction in area, per cent	33.5
Scleroscope hardness	52
Brinnell hardness	286

Knowing that stainless steels of high chromium contents are more resistant to oxidation and show remarkable properties of nonscaling at high temperatures, a series of the 19 per cent chromium steels were made for castings requiring these properties.

The scrap charges for these heats consisted of stainless steel returns from previous heats and Swedish iron. As with previous heats, the scrap was covered with a blanket of burnt lime to reduce oxidation to a minimum and after melting, additions were made of coal, lime, silicon and aluminum to secure proper reducing conditions. In spite of great care in adding reducing agents, some of the heats picked up more carbon than was desired, which, as previously mentioned, was hard to prevent. This decided rise of final carbon seldom is experienced when making larger heats of stainless steel with the corresponding heavier slag, as there is sufficient depth of slag to prevent fine coke or coal coming in contact with the steel. The melting of a small amount of carborundum brick would not change the final results materially. When greater skill and knowledge was obtained in making this steel, the total time for these heats was shortened from 4 to 2 hours and preliminary tests for analysis were entirely eliminated as the alloy additions could be calculated accurately even when using stainless steel scrap in the charges.

Annealing Helps

The analysis of the first heat in the 19 per cent chromium series finished: Carbon, 0.40; manganese, 0.65; chromium, 19.67; silicon, 0.42 per cent and with the sulphur and phosphorus low. The annealed test pieces gave physical properties as follows:

Tensile strength, pounds per square inch	105,250
Elastic limit, pounds persquare inch	88,150
Elongation in 2 inches, per cent	15.6
Reduction in area, per cent	18.5
Scleroscope hardness	39
Brinnell hardness	217

Heating this same steel to 1800 degrees Fahr., quenching in oil, reheating to 1400 degrees Fahr. and air cooling decreased rather than in-

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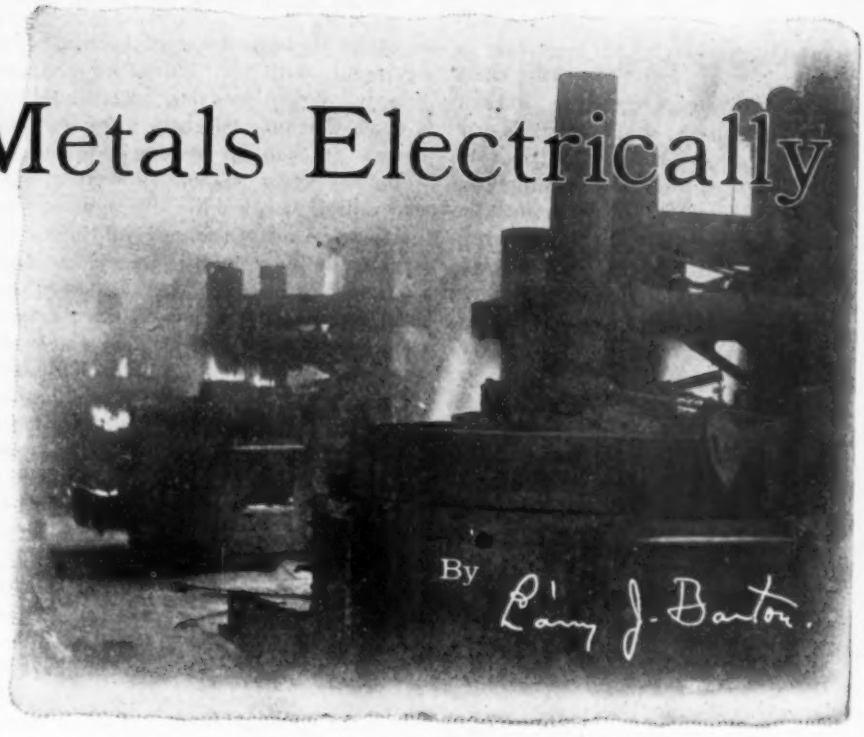
Refining Metals Electrically

Chapter VII

Making White Irons and Alloy Mixtures—Acid Practice Described



WHITE irons have as their main characteristic a high degree of hardness. This qualification fits them for their greatest use, which is for parts subject to great abrasion, as in grinding and pulverizing of ores and miscellaneous minerals. The ordinary grade of white iron, as made in the cupola, offers considerable difficulty to the foundryman if a high quality product is desired.

This metal has a much higher freezing point than has ordinary gray iron, with the result that a ladle of white iron must be handled quickly if it is to be poured free of heavy skulls. Consequently, the cupola is forced heavily to melt this iron at the highest possible temperature, and quite often a large amount of the iron must be pigged, being too cold to pour.

In view of the foregoing, it is natural that many castings are poured with iron practically at the freezing point. The evident result is castings full of defects, caused by the inability of both gaseous and solid inclusions to free themselves before the iron sets in the mold. For these reasons the average foundryman will tell you at much length of the difficulty of handling this metal, and will offer such facts as the high melting point of the iron, its tendency to crack in the mold, its troublesome frequency of blowholes, shrinkholes, draws, and seams, in proof of his contentions.

While it is true that white iron from the cupola offers much difficulty, the exact opposite is true of that class of metal as melted in the electric furnace. The electric furnace will superheat to any temperature and for this reason the iron may be made so hot that any class of castings can be poured with ease. Castings poured from electric furnace white iron are practically free from those defects caused by cold metal, which in hard iron constitutes the greatest reason for lost castings. When to this great advantage the ability to refine and keep to regular analyses is added the electric furnace easily proves its superiority. Of late years, the use of alloys, in these irons intended as a resistant to abrasive action, steadily has increased. Here again the electric furnace offers the economical and important characteristic of being able to reclaim a large percentage of the high priced metals.

The writer for a considerable length of time was engaged upon the development of a special class of white iron, intended for use under the heaviest kind of service, where resistance to abrasion was desired, and where the metal resisted shock to a marked degree. From these experiences a considerable amount of important, and interesting data were obtained upon the manner in which such irons reacted to melting, both in the cupola and in the electric furnace. From these observations, the writer has no hesitancy in stating that white iron, as made in the electric furnace under good metallurgical practice, offers superior qualities to anything on the market for abrasive purposes, except it be manganese steel, and in certain instances when the cost factor is considered—is ahead of this alloy steel.

For those who are not thoroughly familiar with the operation of various grinding equipment the writer will give a short resume that the desired properties of such an iron may be brought to light.

Class 1—Operations where only resistance to abrasion is desired.

One of the outstanding examples of such work is the mixer blade, or paddle, used in forming the center of a concrete pipe. This class of pipe largely is used along the Pacific coast for irrigation work, being made in sizes from 8 inches in diameter up to about 36 inches. A form is made, the inside diameter of which is the same as the intended outside diameter of the pipe. A central shaft, which may be raised and lowered, has several paddles attached of such a size that their path of rotation is the circle forming the inside diameter of

Must Be Both Hard and Tough

MANY services to which white iron castings are adapted have other requirements than the property of glass hardness for which this metal is known. In some instances abrasion is accompanied by shock, as in the case of liners and balls for the heavy mills used in ore reduction plants in the west. The author believes that electrically melted white iron has many desirable features, and that such a metal is superior to the product melted in the cupola. He explained why cupola metal is difficult to handle due to temperature conditions and difficulties in controling the carbon content accurately. He gives his experience in making white iron castings from metal melted in an acid lined furnace. In the forthcoming portion of this chapter he will tell of basic practice on white iron.

the pipe. A batch of concrete is mixed and poured in a rather thick and pasty condition into this outside form. The blade shaft then is rotated and lowered into the concrete, the force of the blades pushing the mixture to one side, and forming the shape of the pipe. As the concrete sets the shaft is raised until a complete length of pipe is formed, when the machine is stopped, the pipe removed, and the operation again repeated.

This concrete offers terrific abrasion against the paddles, and also the outer shell. As the shell wears away, larger blades may be used until the tolerance is too great, when another shell must be placed in operation. This also is true of the blades which wear away extremely fast.

Similar examples are met with in certain pulverizing operations where the iron is used in the form of rollers, shells, etc., the material being pulverized ranging from common bricks to ordinary lime for building purposes.

Class 2—Where a certain resistance to shock must be had in addition to the abrasive resistant properties.

The most common example of this is in the ordinary ball mill, used principally for grinding ores, miscellaneous minerals, and cements. White iron castings find use in these ball mills under two main headings, as the balls, and as liners. A ball mill is a large cylindrical machine arranged to rotate on its axis in a horizontal direction. The outer shell of the machine usually is constructed of heavy steel plate, so arranged that the cast liners fit against it to form an inner lining of from 2 to 4 inches thick, depending on the make and size of the mill. A large number of cast iron balls and a certain amount of ore are charged into this mill. The mill then is started revolving, the movement of the balls grinding, and then pulverizing the ore. The mill is arranged with screens of the desired mesh so that as the ore is pulverized it passes out these screens, its place being taken by fresh ore.

A ball mill is operated to produce fine material on a tonnage basis and anything which means a shutdown rigorously is avoided. Shutdowns are caused by two main reasons, the failure of a liner, or by the balls breaking up so fast that they clog the mills output, when the machine must be stopped until these ball fragments can be removed. When it is considered that some of these mills have a lining weighing 35,000 pounds, with a ball charge of 68,000 pounds, it is easy to see that the movement of such a body of metal, with the added ore charge, offers a severe wearing action. Often a load will clog slightly allowing the charge to ride up on one side before slipping, when the entire contents of the mill is thrown heavily against the bottom. Under such conditions of service, a high quality iron is needed.

The common cupola grades of white iron had at the period of the writer's research, proven so poor that the leading operators of ball mills had lost faith in such casting. Manganese steel was widely used for the liners, while forged balls of chrome steel were finding a ready market. There were several points derogatory to these metals. The manganese steel under the heavy peening action of the balls, tended to flow together at the joints with such force that a perfect weld often was made. When it became necessary to repair one part of the mill, considerable time was expended to tear these welded plate loose from one another, the burning torch often having to be called in. With the steel balls, it was found that the wear was excessive, and due to the heavy freight rate, they came from New Jersey and were used in the Pacific states, their cost was too high for economical operation. However, these metals were reliable in that there was no possibility of a breakdown on the first few hours run, as was often the case with white iron.

Class 3—Where the product offers heavy abrasion and at the same time must not be contaminated with pieces of broken material.

This feature is desired in one of the industries using probably the greatest tonnage of white iron parts cast, that of cement making. The cement rock is pulverized in the ball mill pulverizers before, and after being burned. With a heavy breakage of balls, this raw cement is contaminated badly with particles of iron, the result being that the later, when the cement is laid the iron comes to light as heavy rust streaks, often resulting in the rejection of completed work, due to the bad appearance of these rust patches. This was true especially of work exposed as in large building and sidewalks, where the reddish streaks made the work unsightly.

Consequently, for cement mill work, a metal was desired with a high degree of resistance to abrasion, and one which at the same time would not break or flake off in service.

From the foregoing, it can be seen that the uses and required characteristics of a first class white iron are about as follows:

The iron must be hard to resist abrasion.
It must be strong and tough enough to withstand a certain amount of shock.
It must have the ability to wear down without flaking or spalling.

Consequently, the manufacture of an iron with the required qualifications involves the best both of metallurgical and foundry practice if results are to be the best.

Before the electric furnace was used in melting white iron, the cupola had been used on this metal for some time. An examination quickly disclosed that the arrangement of this cupola was such that its further use would only result in more trouble. The percentage of castings which were being brought back was enormous and losses in the shop were out of all reason. To check the more common troubles, the returned and lost castings were segregated according to their various defects. It was found that practically all of the defective castings could be placed among the following classifications:

Blowholes, large size.
Small pin holes, under the surface skin of the casting.
Large interior shrink cavities.
Slag inclusions.
Sand spots.
Misruns, wrinkles, and seams.
Microscopic cracks, pits and tears.
Brittle iron and cracked castings.
Swelled or warped castings.

It was plain to see that the majority of these troubles were due to the pouring of the metal in a cold condition, and the electric furnace was brought into play. The first operations were conducted on the acid hearth.

Acid Practice on White Irons

LOW silicon irons being extremely scarce, steel scrap, together with a certain amount of returned white iron, were used for the charge on white iron made in an acid lined furnace. Steel borings being rather cheap, in proportion to other classes of scrap, were used in large proportions. The practice was to charge enough scrap to cover the hearth thoroughly, then to charge the recarburizer, figured at 3.50 per cent carbon, the effectiveness of the carbonaceous material being taken into account. As soon as the bath was melted, a test was taken to determine the carbon content of the metal. If this was low, the metal was boiled vigorously by using green wood poles.

Lower carbons were desired than is common in gray iron, a figure between

3.00 and 3.25 per cent carbon being considered ample for this class of work. Such a percentage was boiling under a heavy blanket of the recarburizer. Several varieties of carbonaceous material were used for this purpose, such as common coke of different sizes, low ash anthracite coal, and retort coke. All of them proved to give satisfactory results, the cheapest probably being the pitch or retort coke, which when ground to a wheat size raised the carbon quicker than any of the others.

Balance the Carbon

When the carbon content of the metal was correct, enough of a slag mixture was added to form a blanket for the bath, sufficient being added to prevent any surface oxidation and to prevent useless radiation of heat. This slag was tried of various percentages of sand, lime, and fluorspar, the mixture giving superior results consisting of about 20 per cent lime, and 10 per cent fluorspar.

As soon as the metal was approximately correct in chemical composition and the temperature was fairly high, the required alloys were added and the heat tapped as soon as these additions had time to mix thoroughly. After a considerable number of heats had been made in this manner, the operations were checked with the following conclusions:

Excellent temperatures of the metal were obtained, absolutely eliminating defectives from cold metal causes. The percentage of work lost by misruns, laps, seams, wrinkles, and coldshuts was cut down to a negligible figure. Blowholes, skin holes, and shrink cavities disappeared immediately.

Carbons were raised easily to the desired point, if proper precautions were observed, but considerable manipulation was required caused by the carbon having a slight tendency to drop toward the end of the heat, especially when a high pouring temperature was used.

Phosphorus and sulphur content were extremely low, and the strength and toughness of the metal was much above that of the corresponding metal as cast from the cupola.

Silicon gave considerable trouble to secure proper regulation, especially on hot heats, where the slag thickened, reducing silica and often resulting in a silicon too high, giving a mottled heat, which proved too soft for the intended use.

Due to the large amount of coke in intimate contact at high temperatures with the silica hearth, a rather heavy erosion of the bottom and side walls was evident, requiring considerable patching and repairing in general.

The castings were subject to cracking, especially in the sand and considerable work was required on every heat to loosen heads, lighten cores, etc.

Due to the lower temperatures of the iron compared with those required for steel some difficulty was encountered in manipulating the slags properly to obtain correct finishing conditions. By taking plenty of time and by the use of larger amounts of lime, and fluorspar, these obstacles were overcome.

The results on acid operation were good, when considered in the light of the iron from the cupola. However, two main objections to this process were noted. These were the poor control of silicon and the tendency of the castings to prove tender in the sand. While these difficulties were common with the cupola metal, it was considered that iron made under the conditions of the electric furnace should not show the brittleness it did. It was thought that the silicon control could be improved. A better class of steel scrap was tried, but the results were similar in every respect. Other changes in the melting practice, especially the temperatures of pouring, etc., were tried, but all methods gave results of about the same character. The hardest problem in this practice was the control of the analyses when melting returned shop scrap, this charge having a great tendency to reduce silicon as it melted, often giving rise to such a silicon content in the metal that hard gray iron was found on the melting down test.

How long will fame follow a man?

As these classes of casting were being made as a high quality specialty the difference of a few dollars a ton in the conversion cost was immaterial, and basic operations was decided upon. The acid lining was torn down, and a basic hearth of magnesite burned into place as if for steel melting. After a few heats it was seen that the change had been a wise one as metal of exceptional qualities and with unusual qualifications was obtained.

G. D. Grubb has been appointed sales manager of the Tulsa district for the Linde Air Products Co., New York, with offices at 508 Exchange National Bank building, Tulsa, Okla.

Brings Old Plant Up To Date

(*Concluded from Page* 514)

various charging floors back of the cupolas.

The cluttered up condition of the gangways persisted over many years and was accepted as a necessary evil. Tentative plans for its amelioration were considered from time to time, but, no definite action was taken until a combination of circumstances forced the issue. The last and deciding factor was the introduction of a pair of sand cutting machines made by the American Foundry Equipment Co., New York. The condition of the gangways prevented these machines from functioning to advantage and as a result, a new method was adopted by which the gangways are cleared shortly after the heat is poured.

A regular night crew removes the castings and prepares the sand for the following day and in that manner full advantage is taken of the mechanical equipment. The crew starts to work at 4 p.m. and utilizes the monorail as much as possible in between the ladles. After the last ladle is poured the night crew has full use of the monorail and between that and the trucks, the castings soon are hustled to the cleaning room, and the scrap returned to the cupola charging platform. With a clear gangway, the sand cutting machines pass readily from floor to floor. With the exception of a few special spaces all the sand in the foundry is prepared by these machines. In the fire pot molding machine section the sand is mixed by passing it through a revolving belt type mixer made by the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Duplexing Cupola Metal

At the regular monthly meeting of the Buffalo Foundrymen's club May 27, J. L. Gibney electro-metallurgist Gibney-McClain Electric Furnace Co., Buffalo, delivered an illuminated address on the subject of metallography and its practical application to every day foundry problems. Particular attention was directed to the duplexing process in which cupola melted metal afterward is treated in the electric furnace. The speaker dwelt upon the many advantages conferred upon metal subjected to this treatment and presented several slides showing the physical characteristics of the metal as compared with the structure of iron melted in the cupola under ordinary conditions.

Co-ordinating Employe Training

Nationwide Plan for Participation by Federal Government, Employers, Universities and Other Organizations—Statistics Show Need for Action To Guard Against Future Shortage of Workers

By L. A. Hartley

A COMPREHENSIVE plan for employe training on a nationwide scale was suggested by L. A. Hartley, director of education, National Founders association, in his address in a group meeting of manufacturers attending the thirteenth annual conference of the Chamber of Commerce of the United States, Washington, May 20. At the conclusion of his address, of which the following is an abstract, he proposed:

1 There should be a national department of training functioning for employers entirely apart from federal departments but co-operating in specific projects with federal and other agencies just as co-operation in the campaign for simplification and standardization has been carried on with the simplified practice division of the department of commerce and the American Engineering Standard committee.

2 Every manufacturers' group and employers' group should maintain an employe training committee the aims of which would be similar to those of the national department.

3 This national department and the committees in these associations should form the nucleus of a National Industrial Training association whose chief aim would be to promote training on the job beginning with the upgrading process. The secondary aim would be to co-operate with those public and private educational enterprises which could be helpful.

4 Material on the subject of employe training should be prepared and made available to all industrial managers throughout the country. This should set forth the need of constantly revised data on the employe training situation and should include also definite suggestions for various methods of erecting systems of training on the basis of what may already be in existence in each center. These plans should recognize the training needed for mechanical skill and for supervision.

5 A co-operative arrangement should be made with one or more of the great universities to carry on a comprehensive study of training methods.

LIKE the action of some great magnet upon a heavy iron bar, restricted immigration is slowly bringing the attention of industrial leaders toward the question of labor supply. American manufacturers seek world markets with four heavy handicaps:

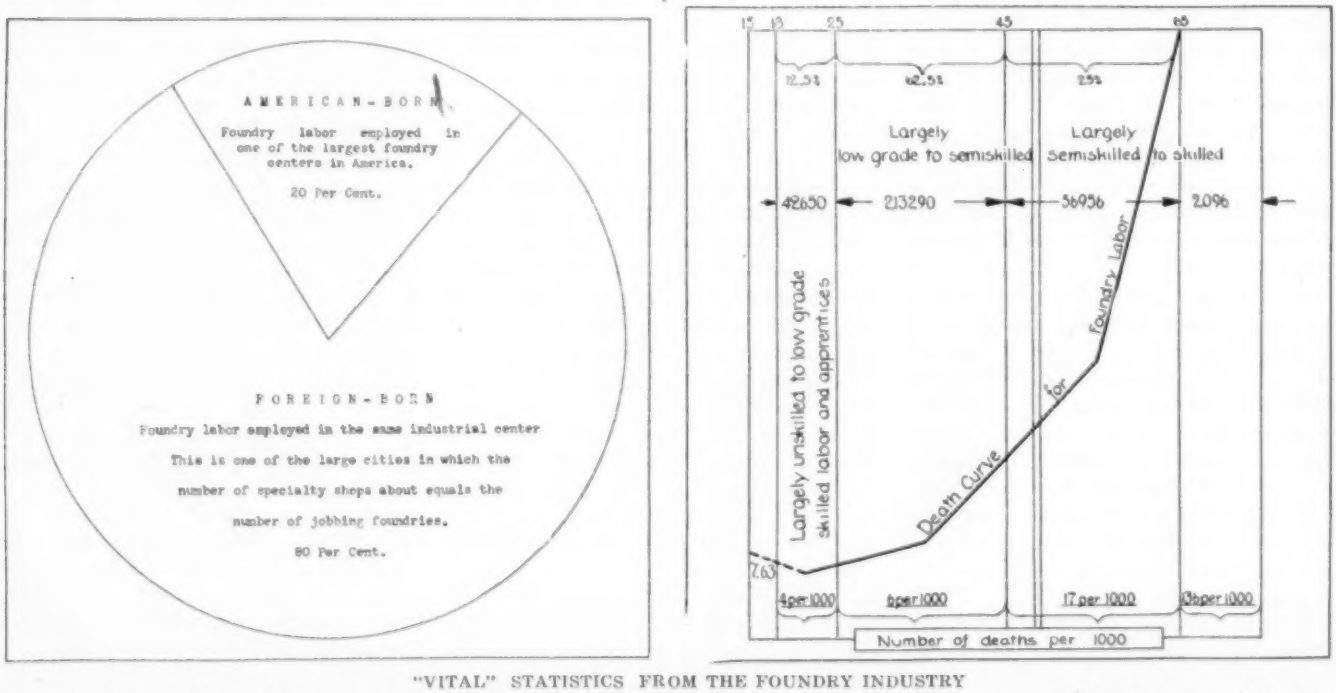
First, higher standards of living.

Second, a declining labor market due to restricted immigration.

Third, a rapid increase in the death rate among skilled workers due to the fact that a majority of our highly skilled workers in many of our industries are older men.

Fourth, the reluctance of American youth to choose manual work in certain industries as a means toward a career.

Europe has a much lower standard of living, an overflowing population combined with the possibility of the return of many of her former citizens who are now skilled workers in American industries, a constantly renewing skilled group which gives a fairly steady death rate for skilled workers and a remarkable appreciа-



"VITAL" STATISTICS FROM THE FOUNDRY INDUSTRY

Proportions of American and Foreign-born labor are shown at the left, while age-groups and death curves are illustrated at the right. The estimated total number employed during a normal year is 315,000. Death rates per 1000 are as follows: For all persons 15 years old 7.63; in the foundry, 18 to 25 years old, 4.0; 25 to 45 years 6.0; 45 to 65 years, 17, and 65 years up, 136

tion upon the part of her youth of the opportunities offered for success in the trades.

Our job is to get ready for this race which we must surely run. No one knows the exact time when the nations of the earth will be called to the starting post. We do know that the race will be run and that we will be compelled to run under these handicaps. It will do no good to bewail these handicaps. The race will begin before they can be removed. In fact, we are already jogging toward the starting post. These are the practice days in which we may get ready for the struggle which is to come.

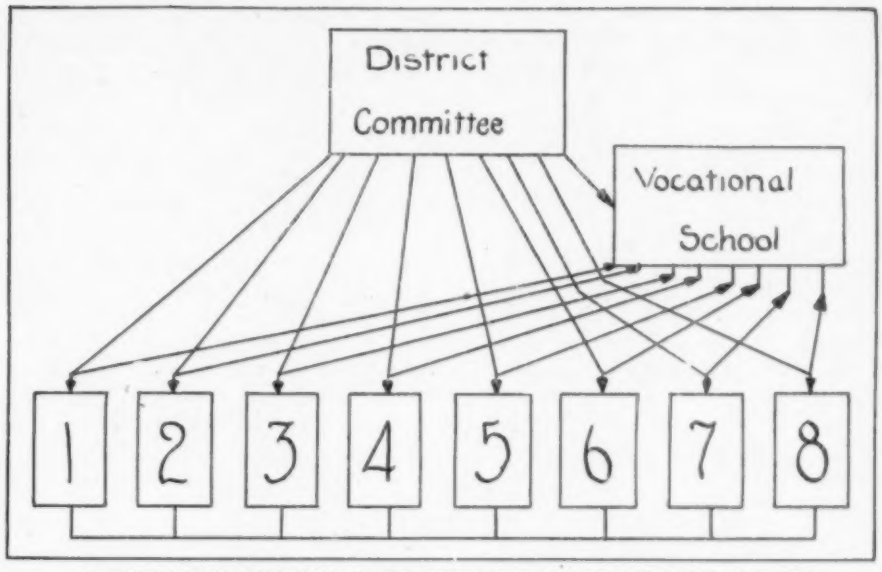
The world markets naturally include both domestic and foreign markets. According to Secretary Hoover "our foreign trade as a whole is quantitatively 50 per cent higher than the prewar level." The nation's exports figures are running about three times as heavy as before the war but since prices are higher the quantity of goods exported has not increased to this extent. With the exception of one brief period, exports for a number of years have been in excess of imports. In March 1925, the value of the exports was $67,000,000 greater than the imports.

This is the time when American manufacturers must act as one man to do what may be done to condition American industry for a test which will surpass in far reaching effect the test we met so nobly during the great war. Never before has America faced a New Europe. Only once has America faced a declining labor market and that was during the late war when the getting of orders was not the large problem. Furthermore there was the strong motive at that time of patriotic duty to urge us on to better effort.

Trade Loss Means Much

We must anticipate conditions. A loss of even 5 per cent of foreign trade means more than 5 per cent loss to America. It means that much less employment in our factories, less producing power of our people, less home ownership, less savings, less schooling for some, less building, less money for pleasure and finally less home life and less happiness for the great mass of people.

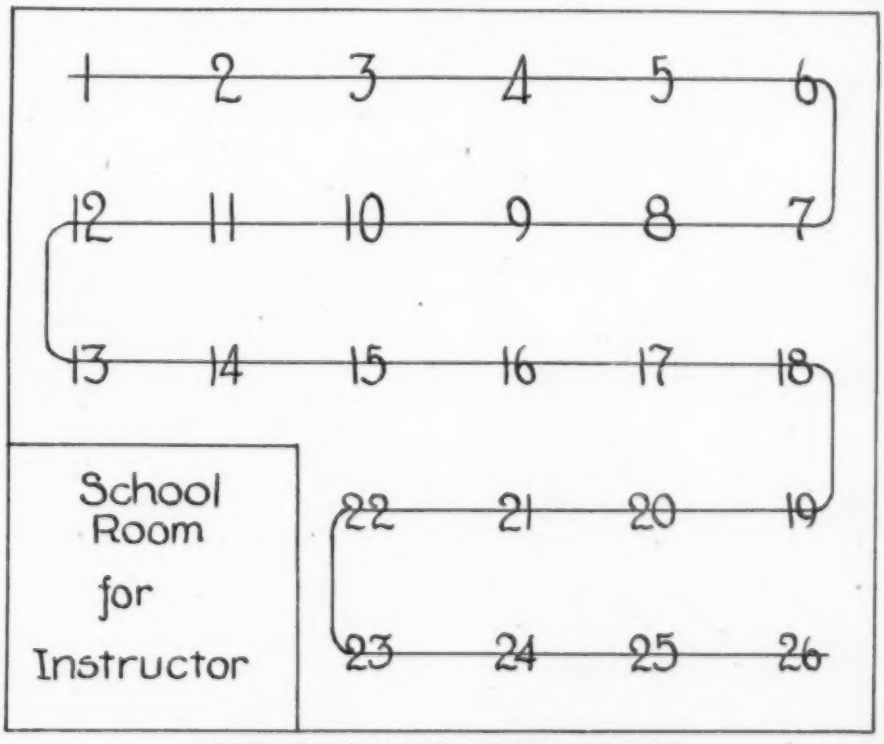
While dealing with the effect of market conditions upon the industrial and home life of our citizens we should remember the conviction of many people that every business proposition which is to endure, must have moral foundation. The weight of moral truth is behind the movement for more effective production and moral truth has power beyond the strength of any group of men. The need for greater effectiveness in production is not advanced as a business proposition alone. It is advanced as a moral necessity in the interest of the men, women and children of America. Improvement in production is urged in the interest of not only employers but more particularly in the interest of the great mass of Americans including working men. It is sound business but it is also sound morality and whenever a moral reason can be urged for a business proposal such a proposition will have the support of all thinking people.



CO-OPERATIVE DISTRICT PLAN, WITH PUBLIC VOCATIONAL SCHOOL

Includes district committee of factory representatives and a representative of the vocation schools; individual plants 1, 2, 3, 4, 5, 6, 7 and 8, in which shop training and some plant courses are given. Vocational school includes three possible types of instruction: Part time for apprentices and others; all-day trade, and evening

It is the purpose of this paper to support each statement with some fact which will enable readers to form judgments. With this in view a chart is included on which is indicated the proportion of foreign born and American labor in one industry in one large center. The foundry industry is used in this illustration because it is a basic industry. It employs approximately 80 per cent foreign born

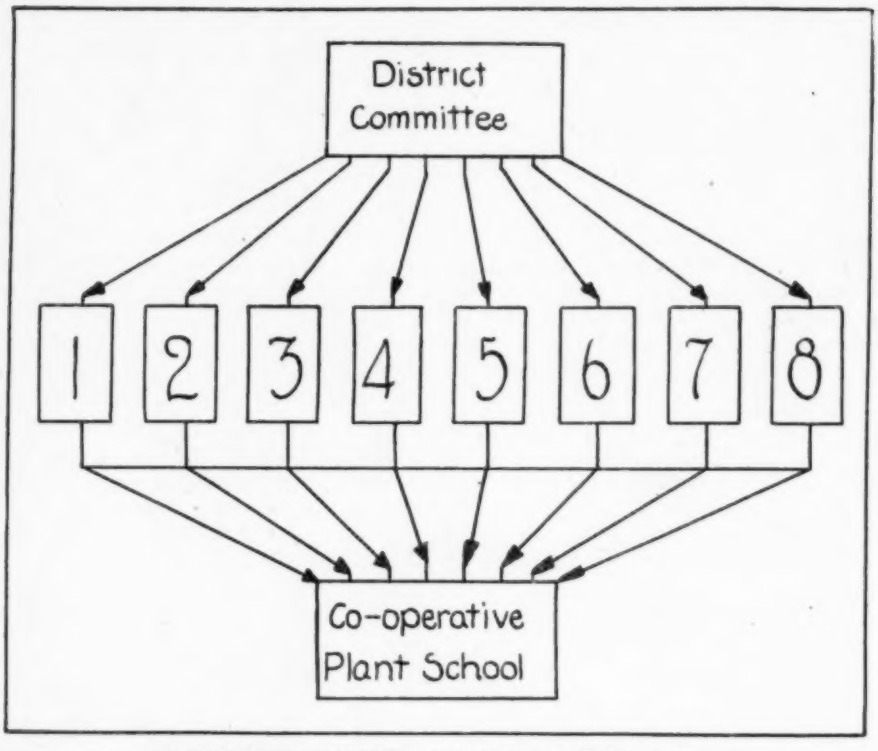


INDIVIDUAL PLAN FOR EMPLOYE TRAINING

Jobs in the plant, one to 26, graded according to learning difficulties and probable line of advancement. Includes school room, equipped simply and set apart for instruction, and an instructor with sufficient time and authority to carry out program

and 20 per cent native born persons.

The age divisions of foundry employes and the percentages of employes in the different age groups are shown on the second chart. These figures are taken from the United States census. The number of deaths per 1000 for each age group in this industry was furnished to the National Founders association by the Metropolitan Life Insurance Co. It will be observed that approximately 12.5 per cent of foundry labor is between 18 and 25 years of age, 62.5 per cent is between the ages of 25 and 45 while 25 per cent is between the age of 45 and 65 and over.



CO-OPERATIVE DISTRICT PLAN WITH PRIVATE SCHOOL

Includes district committee of factory representatives and a representative of the vocational schools; individual plants 1, 2, 3, 4, 5, 6, 7, and 8 in which shop training and some plant courses are given, and co-operative plant school in which related mathematics, science, drawing and foremanship methods are taught

An investigation of one year's records of labor in more than 500 foundries leads to the conclusion that the great majority of foundry workers skilled in all round practices of the trade as well as the great majority of foremen and supervisors are found in the upper age group. Naturally there are many skilled workers and foremen in the middle age group and some even in the youngest classification, but the great majority are in the oldest group.

The death curve for this industry is seen rising rapidly through the last 25 per cent of the personnel. The double line paralleling the 45-year line shows the average age at death of all white occupied males which is 48 years and this is practically the average age at death of males employed in this industry. The average age of the highly skilled group is 55 years while the average age at death is 48. This means that the average age of this group is already seven years beyond the average death age of all white occupied males. No insurance company could be found which would be willing to insure such industries against the loss of skill and supervisory ability.

It may be mentioned here that the figures in a statewide survey of another industry indicate the same general condition as to skill and age. In fact, in some centers more skilled workers in this trade were found to be over 65 years of age than under 35 years.

Another point which should be noted in connection with this chart is the small number of children less than 18 years of age engaged in foundry work. The number is so small that the census table does not record them. A careful estimate places this number of children less than 18 in all American foundries at about 1,000. This is mentioned because it is believed to be true of many other industries. In other words it has always been realized that labor in the basic industries must possess a high average of physical strength.

If Europe can no longer be depended upon to contribute to our skilled group and if many of the skilled workers today are too old to be depended upon for any length of time, we may naturally turn for assistance to American youth.

The minimum age at which an industry may desire to employ children has a very important bearing on employe training. This is in part because of the emphasis given to the training of children in the continuation and trade school throughout the country. One of the greatest dangers confronting industry in the training of labor is from over-confidence in the present school training agencies.

The trade schools erected at great public expense and doing excellent work for a limited number of industries are a mere drop in the ocean of the training required by American manufacturers. In 1924, according to the eighth annual report of the Federal Board for Vocational Education, 33,262 students were enrolled in federally assisted all-day trade schools. Of this number about one-fifth were girls and women. This total number of students in federally aided all-day trade schools was only about one-tenth of 1 per cent of the 27,530,121 persons who according to the 1920 United States census are employed in trade and industrial occupations. According to this report about an equal number, 35,475, were enrolled in trade extension courses in which students study a few hours per week. The continuation schools attended by 256,133 employed children in 1924 for four hours or more a week might be expected to offer more assistance to industry, but here the age at which industries desire to employ children must be considered.

School Facilities Inadequate

No criticism of federal, state or local vocational authorities is intended. The only purpose in making these statements is to bring to the minds of employers the inadequacy of federal or local public school facilities for the employe training needed by industry. The work which the Federal Board for Vocational Education is sponsoring throughout the country is to be highly commended but it is only fair to the situation to observe that in 1924, after eight years of the operation of the Federal Vocational act, the total enrollment in these federally aided industrial classes throughout the whole United States was only 409,843 of which 62 per cent were children attending general continuation schools for a few hours per week. Great credit should be given to this effort. It has certainly

LUBRICATION OF AIR COMPRESSORS

(Concluded from Data Sheet No. 578)

STEAM CYLINDER LUBRICATION

For steam cylinder lubrication, a good grade of steam-cylinder oil should be used. This oil also may be obtained from a reputable oil company that will recommend the proper oil to use for the steam conditions encountered. The proper quantity of oil to be fed to the steam cylinder is much greater than that required by air cylinders, due to the constant washing away of the oil by the steam. Approximately four times as much oil will be needed in the steam cylinders as in those for air, subject, of course, to variable local conditions.

Depending on its viscosity, a pint of steam cylinder oil will furnish from 5000 to 8000 drops, and taking an average of about 6500 drops, and four times as much oil as air cylinders of same size, and working at same piston speeds, the recommended amounts to feed the steam cylinders or their equivalents are given in the following table:

QUANTITY OF OIL FOR STEAM CYLINDER LUBRICATION

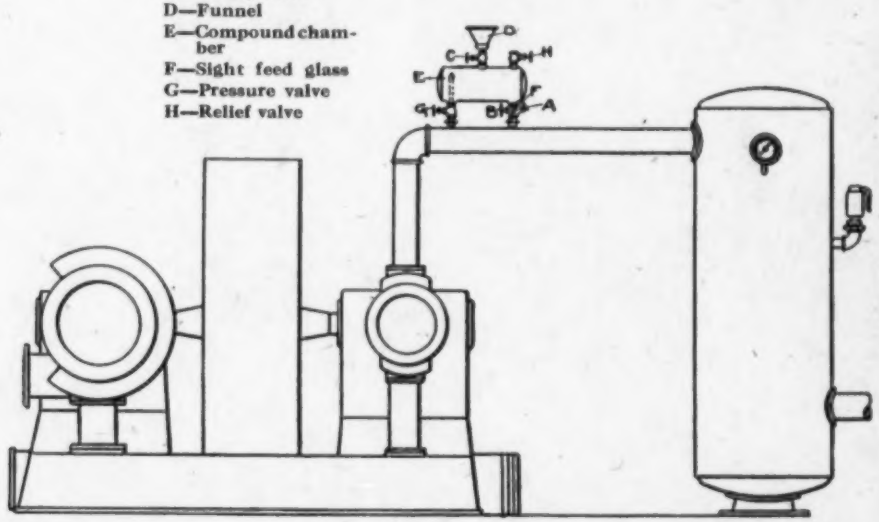
No. Drops Per Minute	Size of Cylinder Inches	Number Pints Oil Required per 10 Hours
4	8 x 8	.40
8	12 x 12	.75
16	18 x 18	1.50
24	24 x 24	2.25
32	30 x 30	3.00
40	36 x 36	3.75
48	42 x 42	4.50

These figures are approximate only, and will vary with the steam conditions, the kind of oil used, and its method of introduction into the steam, also with the boiler compound carried by the steam into the cylinder.

CLEANING RECEIVER PIPING

It usually happens that oil, carbon and other foreign matters are deposited in the air discharge lines and air receiver. A practical method of cleaning these is shown herewith, where a receptacle made of 5" or 6" pipe is shown set on top of the discharge pipe. The illustration shows plainly the construction and what the different parts represent. If a mixture of one pound of red seal lye and 18 pounds of water is passed into the discharge line at the rate of 60 or 70 drops per minute while the compressor is running, this will clean out all the accumulation on the surface of the pipe and in the receiver, and if the blow-off valve on receiver is opened, all of this foreign matter will be discharged. This cleaning solution should be used every month or oftener, depending on how much accumulation there may be in the receiver.

A—Shut-off valve
B—Regulating valve
C—Filling valve
D—Funnel
E—Compound chamber
F—Sight feed glass
G—Pressure valve
H—Relief valve



To use the compound, close the valves, A and G, open valves, C and H, and fill with compound through the funnel, D. When the chamber, E, is filled, close valves, C and D, open valves, G and A and regulate feed by valve, B.

THE FOUNDRY DATA SHEET, JULY 1, 1925

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

Around the World with The Foundry

Little Journeys to the homes of our readers

China

CHINA—the cradle of the human race, the largest and most densely populated country on the face of the earth—a country the history of whose people antedates that of any other known race—has only been accessible to foreigners since 1842 when Hong Kong was ceded to Great Britain and the four great treaty ports, Amoy, Fu Chau, Ning Po and Shanghai were thrown open to the commerce of the world.

Some of the most marvelous castings ever produced in either bronze or iron have been made in the little one and two-men shops scattered over the length and breadth of a country having an area approximately equal to that of the United States of America.

No data are available on the number of these places, but there are 12 first class, modern foundries making everything in the casting line from stoves to battle-ship engines.

To every one of them The Foundry is delivered twice a month and helps to keep the executive staff in touch with the latest worth-while developments in the foundry industry.

The tourist fortunate enough to be shown through one of the immense casting plants in Hong Kong or Shanghai will find this familiar looking magazine lying on the office desk and will realize that

"Wherever metals are cast you'll find THE FOUNDRY"

kept alive the question of training for industry. It is impossible, however, for the public schools to give the comprehensive, varied and continuously changing instruction needed in industry. The public schools can and do assist greatly but quite naturally they are giving most of their attention to children.

Another school factor which operates against the heavier basic industries is the age at which the majority of children leave the public schools and are available for employment. According to the 1920 census there are approximately 4,000,000 children 14 and 15 years of age in America and of this number about 80 per cent are in school. In other words, of all children in America, 14 and 15 years of age only about 20 per cent are available for employment. Approximately 43 per cent of all American children 16 and 17 years of age are in school, leaving 57 per cent of the children of these ages who are out of school and available for industry.

Must Train Own Men

The total number of children 14, 15, 16 and 17 years of age out of school is approximately 3,000,000. These take up lighter employments and get started on many of the so-called white collar jobs as clerks or in offices. Statistics from many school systems suggest that the average age at graduation from high school is about 18, which is also the minimum age at which children are available for employment in heavier industries.

The outstanding conclusion drawn from these figures of student turnover is that only the lighter industries may expect much help from trade instruction in school and that heavier industries must either plan to train on the job those children who come to them after several years of work in lighter industries or take high school graduates.

The Milwaukee type of employe training is called the co-operative district plan including a public vocational school. It is shown graphically in one of the accompanying charts. This is considered by some to be the ideal training system. Its particular aim is the training of young men as regularly indentured apprentices in certain well defined trades. The public vocational school in which some of the related instruction is given to apprentices is used also for all day trade and also for all evening classes.

The other two charts indicate the setup of two other systems of training, one in an isolated plant and the other in a group of co-operating plants, both of them without the assistance of the public schools.

Making Cast Stainless Steel

(*Concluded from Page* 518)

creased its physical properties, as is shown from the following:

Tensile strength, pounds per square inch	119,850
Elastic limit, pounds per square inch	84,050
Elongation in 2 inches, per cent	9.4
Reduction in area, per cent	10.0
Scleroscope hardness	45
Brinnell hardness	217

To show how the hardness of this 19 per cent chromium steel is affected by different hardening temperatures, the plotted results are given in Fig. 3. It readily is apparent that

Of course, you know
George Wadsworth
Ed Woodison
Sam Johnston

the greatest hardness is secured when the steel is quenched at 2000 degrees Fahr. Taking this same steel and reheating to various drawing temperatures, further physical data were secured. Comparison of these results with similar data from one of the 13 per cent chromium is shown in Fig. 4. Since making these experimental heats, extensive data on the physical properties of the rolled 13 per cent chromium stainless steel have been published. However, at that time some rolled stainless steel was secured, quenched in oil at 1650 degrees Fahr. and reheated for drawing at temperatures shown in Fig. 5. Had this steel first been oil quenched at about 1800 degrees Fahr. much higher physical properties evidently would have been secured at the different drawing temperatures.

Costs May Vary

The cost of making stainless steel in the electric furnace depends on several factors, such as the particular type and tonnage to be produced, the method of operation and size furnace available and the cost of scrap and alloys used. A few methods of operation are given here to show how metal costs may be affected by several dollars a ton. Variations of the following methods may be made to apply to local conditions and materials available.

Method No. 1

Charge selected melting scrap, low in carbon, phosphorus and sulphur. When melted and in a slightly reducing atmosphere, the carbon in the bath should be 0.10 per cent or under. Additions of ferrochromium low enough in carbon may be made as fast as practical, so that the final carbon in the steel is under 0.30 per cent. Steel should be finished under reducing conditions of good tool steel practice.

Method No. 2

Charge ordinary low carbon steel scrap with phosphorus and sulphur under 0.05 per cent. Oxidize phosphorus with ore or mill scale, removing slag when phosphorus is low enough. When steel has been deoxidized in part by lime and coke, make additions of ferrochromium as outlined in the first method.

Method No. 3

Charge ordinary low carbon steel scrap, oxidize phosphorus and remove oxidizing slag after reactions are completed. When a new slag of lime and fluor spar has been formed, add a predetermined amount of calcined chrome ore and reduce the chromic oxide with such reducing agents as aluminum, silicon, titanium, coal, etc. After this reduction any adjustments in chemical analysis may be made with ferrochromium should the preliminary tests indicate that they are necessary. The steel should be finished as usual.

Some costs have been tabulated in Fig. 6 to show how different percentages of chromium affect the final cost per pound of metal in the ladle. In the figures given, it is assumed selected scrap, low in carbon, phosphorus and sulphur can be purchased at $30 a net ton and the alloys bought at the figures given. The price of ferrochromium ranges from approximately 4 cents per pound ferroalloy containing under 6.00 per cent carbon, to 40 cents per pound ferroalloy which contains under 0.10 per cent carbon. In the figures cited, medium priced chromium has been selected. Cost of conversion, that is converting scrap and alloys to finished metal, is omitted as furnace costs vary according to the method of procedure and other important factors must be taken into consideration.

In this article the author has refrained from discussing many of the metallurgical considerations on the effect of chromium and other elements on stainless steel and also the most suitable heat treatments, desirable physical and stainless properties. These subjects already have been covered by other writers.

How and Why in Brass Founding

By Charles Vickers

Removing Fins by Dipping Bronze Castings

We have certain classes of bronze castings, particularly centrifugal pump impellers, which are difficult to clean inside, as the water passages are narrow and it is almost impossible to prevent fins from forming when these are poured. We have thought of removing these fins and burrs by a pickling process, the general method contemplated being to dip the rough castings, first in a bath of muriatic and nitric acid, followed by washing in warm water and next dipping in a bath of sulphuric acid, which we understand is for the purpose of removing the effects of the first acid bath. Then we would wash the castings in a hot soda solution, and then immerse them in an oil solution to prevent oxidation during the time they may lie around in rough stock waiting to be machined. We are hesitating to install this acid method until we learn whether any method of this general nature is being used successfully in brass foundries.

We will confess the process does not appear feasible to us. Assuming for instance that the proposed acids are suitable for the purpose, we are unable to visualize them attacking and dissolving the objectionable fins, in preference to other parts of the castings. It would be necessary to paint all parts of the castings, not to be attacked, with some insulating covering, to confine the activities of the acids to the points to be dissolved. Since the water passages are narrow and tortuous, we should look on this procedure as being impossible on a commercial scale.

It would be educational to try out the idea by submitting a small casting to some plating establishment and have them make a trial first, explaining what is desired. Then if the process does offer promise, have the platers superintend the installation.

Usually nitric acid is used for dipping castings in conjunction with sulphuric acid, and the following formula generally is used: Sulphuric acid, 2 gallons; commercial nitric acid, 1 gallon; common salt, 2 ounces. For pickling brass use the following: Nitric acid, 1 gallon; water, 2 gallons; and muriatic acid, 6 gallons.

We know of no foundries using such acids for removal of fins from castings. Dipping is practiced to improve the appearance of the castings. We believe that research directed toward the development of a coating to protect the cores will be more hopeful of results.

To Stop Cores Blowing

We have difficulty with the cores blowing in small brass castings the shape of which resemble cast iron water pipes laid under the streets of cities. The core is about 9 inches long and 5/16-inch diameter except for a short distance at one end where it expands to ½-inch diameter. The cores are made of silica sand bonded with oil, making the mixture as weak as possible, and we vent the cores all the way through, and have tried various compounds, and rosin with poor results. The patterns are on a plate and dryers are furnished. The castings must be run hot, and the metal must be forced into the mold, otherwise they fail to run. We elevate the pouring end of the mold two inches.

The sample casting furnished shows that the cores are poor examples of the coremaker's art, as they are neither round nor square, though they should be round. It is possible that the core box is worn out, or it may have been constructed by amateurs. For such castings a perfectly round, well fitting core is a necessity, as it is essential to obtain a vent that will be entirely throughout its length. The flasks also must be close fitting. There must be no shifting of the pins as revealed by the sample casting. An oil sand core is the best to use for such work, but it must have a vent clear through it, and the prints must fit the mold so that no metal enters the vents. If the core prints do not fit the mold print, the metal may be kept out of the vent by using paste. However, this is a time-consuming operation for small plated patterns. The method of pouring is good, but we fail to see the necessity of pouring with such hot metal. It is possible the gating is at fault.

It should not be necessary to make the cores weak. Perhaps they are too weak. A sound, well-shaped core having a small hole entirely through its length is required, and no metal must be permitted to enter the vent.

Have Difficulty Making Bronze Castings

We have experienced some difficulty while making a large bronze casting 72 inches in diameter. It was made in a dry sand mold, poured through four ½-inch by 1½-inch pop gates on the rim; no risers. The mold was faced with a mixture of one part new Millville and two parts of burnt Millville gravel, with a cinder bed four inches below the face of the pattern. The metal was composed of gun metal scrap, composition 87 per cent copper; 10 per cent tin; 3 per cent zinc, to which was added 4 per cent of lead. The casting was poured at a temperature of 1950 degrees Fahr. The first casting we made was good, but we have made three since and all were bad. The fracture of the metals contains discolored areas, and it appears peppered with specks of a dark constituent. When turned the surface of the metal tears as though crystals had been ripped out in blotches. We send a sample for your inspection and will be glad to have your comments.

This alloy is similar to admiralty bronze 88-10-2 alloy the unsoundness of which was investigated some years ago by Carpenter and Elam and the results of the investigation were embodied in a paper presented before the Institute of Metals at the annual general meeting in London, England March 14, 1918, and which will be found in Vol. XIX, *The Journal of the Institute of Metals*, pages 155-220. A copy of that publication may be obtained from the secretary of the Institute of Metals, 36 Victoria street, Westminster S.W., London, England. It was found as a result of this investigation that the best pouring temperature for the alloy in question is about 1200 degrees Cent., (2192 degrees Fahr.), and that pouring below 1100 degrees Cent., (2012 degrees Fahr.) often produces unsoundness. As the castings in the present case were poured at 1950 degrees Fahr., this matter of the pouring temperature deserves consideration. The first casting might have been poured hotter than the ones that were defective and as one possible solution of the difficulty we suggest a study of this question.

Apart from the question of pouring temperature a superficial examination

of the sample furnished favors the idea that the metal was oxidized. However, a magnifying glass shows the fracture to be filled with hair cracks and minute holes. When the machine tool goes over the surface it strikes edges of these cracks and rips them off, thus giving the torn appearance. These cracks are not the result of direct oxidation of the metal, but the result of the reduction of oxides within the metal by hydrogen, which of course produces superheated steam under tremendous pressure. This has the power to force the grains of metal apart and produce fine fissures. It is not likely this would happen while the metal was liquid in the furnace. It must have happened after it solidified within the mold, and if so, the question arises; where did the hydrogen come from? Was it from decomposition of moisture, which begins at 1000 degrees Cent., or from a distillation of some organic substance used as a binder or as a facing, and did the pouring temperature figure in this result. It does not appear that the mold was to blame although even a dry sand mold contains moisture, but no matter how this may be decided the beginning would be found in the oxidation of the metal, and this brings up doubts about the scrap, clean fractures of which will not be harmed by examination. Then the remedy is to phosphorize the metal slightly early in the heat and give time and temperature for the fluid to clean itself as much as is possible.

If the metal had been gassed in the furnace, the castings would be filled with small holes, clean and more or less globular in shape, and the remedy would be oxidation of the alloy while in the furnace, preferably by the addition of oxides, or oxidizing substances, instead of adding deoxidizers.

Nonshrink White Metal

Will you kindly send me a formula for a nonshrink white metal.

About as good a nonshrink white metal as it is commercially possible to make is the following alloy: Zinc, 50 per cent; tin, 50 per cent. Melt the zinc first and add the tin; it is not necessary to pour hot. This alloy, of course, has a little shrinkage, but not enough to take notice of in making ordinary white metal patterns.

Test Magnesium as Brass Deoxidizer

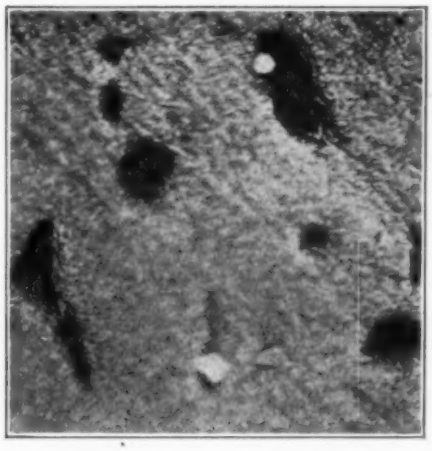
By C. V. Nass
Ohio Brass Co., Mansfield, O.

USE of deoxidizers for red brass has become general practice in many foundries. Silicon, magnesium, and phosphorus are used most commonly, a small amount of a copper alloy of one of these metals being added to the brass just before pouring. The purpose, as implied by the word deoxidizer, is to reduce any oxides contained in the molten metal, thereby increasing the quality of the casting.

An experiment recently was conducted in our foundry to determine the effectiveness of magnesium and phosphorus as deoxidizers. Our ordinary practice employs phosphorus. For this experiment test bars were cast of an alloy, containing 79 per cent copper 3 per cent tin, 9.5 per cent lead, 8.5 per cent zinc. The bars were poured from the same melt and under identical casting conditions, except that to one ladle phosphor-copper was added, to another magnesium-copper was added, and to a third no deoxidizer was added.

Physical tests showed that best results were obtained by using phosphor-copper. The use of magnesium-copper even proved detrimental. The ultimate strength, reduction of area, and elongation of the test bars in which magnesium was used, was much lower than the same properties of the bars to which no deoxidizer was added. The fractures of the test bars which contained magnesium were discolored badly, exhibiting areas of a golden brown color which is characteristic. The fracture also was more pronounced than in the fractures of the other test bars.

Specimens were taken from these test bars for microscopical examination. This showed that the test bars in which magnesium had been used



PHOTOMICROGRAPH OF UNETCHED SPECIMEN X 350 DIAMETERS

contained small amounts of oxide films. It also revealed the fact that a new constituent was present, which appeared as small dots or small rectangular particles of a grayish white color. This was distributed throughout the metal, generally in conjunction with the lead areas. The accompanying micrograph of an unetched specimen, magnified 350 diameters, shows a typical area containing spots of this constituent.

As the physical tests had shown that it would be a disadvantage to change from our present dioxidizer, namely phosphorus, to magnesium, no detailed investigation to identify this new constituent was attempted. However, several specimens of the alloy containing it were heated to various temperatures, held for one half hour and quenched in water to determine the approximate temperature at which the constituent disappeared. This was found to be around 950 degrees Fahr.

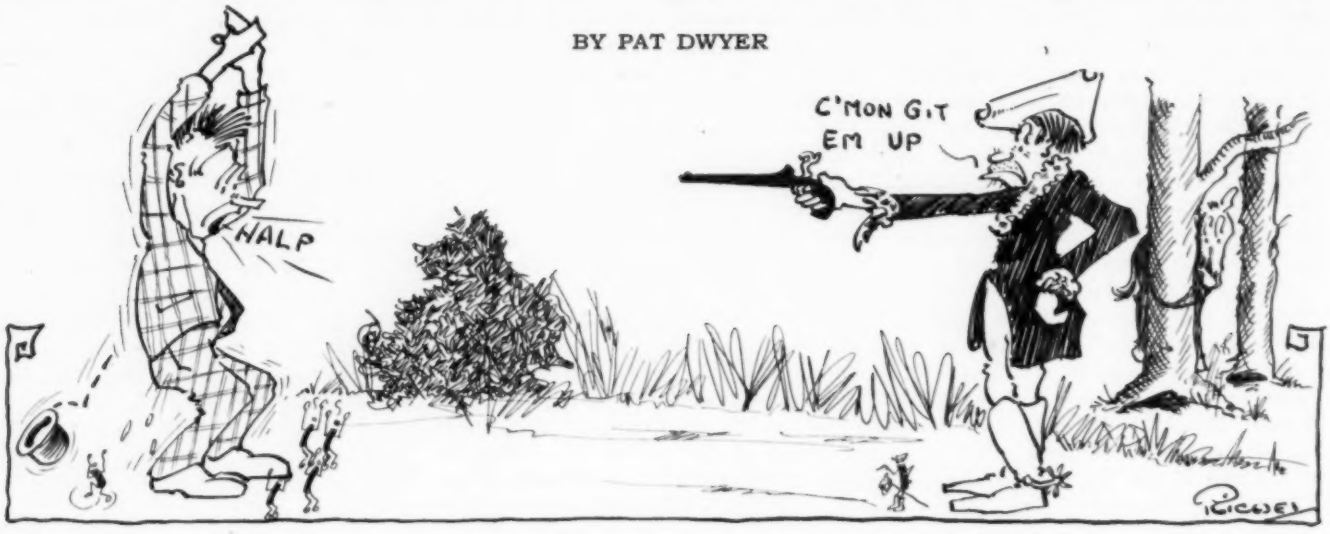
Chemical analysis showed that only 0.02 per cent of magnesium was present. Evidently it had combined with one or more of the elements in the brass to form the constituent detected under the microscope. If uncombined, such a small percentage probably would not be detected at the lower magnifications.

Since only 0.02 per cent of magnesium remained in the alloy, the constituent disappears around 950 degrees Fahr., and it occurs in conjunction with the lead areas, a low melting constituent is indicated. However without further investigation no definite statement may be made as to its identity.

The fact that when used as a deoxidizer in red brass, the magnesium remaining in the metal does form a deleterious constituent, and that it leaves appreciable amounts of oxide in the metal, detracts from its effectiveness as a deoxidizer. Small amounts of phosphorus or silicon remaining in the metal increases its strength appreciably.

Bill Touches on Robbers and Loam Pots

BY PAT DWYER



PROBABLY if I had the necessary time and patience to hunt around I could discover a treatise or a brochure of some kind devoted to an explanation of a curious twist of the human mind that always has puzzled me. I am not enthusiastic to start on this search, because on the few occasions I have attempted to read literature of that character I have conceived a violent dislike for the author. I am a man of peace, actuated by a laudable desire to live in harmony with—well, with the majority of the human race. I can think of no violent or active enemy at the moment and simply insert this clause as a precautionary measure. I may have to consult one of these references any time and I want to feel free to express my opinion of him or her. My own private opinion is that *it* is the most suitable term to apply.

I have not lost any sleep over a solution to the problem and will not feel that my life has been wasted even if I never find the answer. I would not have you gather the general impression that I brood over the subject night and day, or that I inadvertently skip a meal now and then through intense preoccupation on a useless line of thought. My clothing still clips me closely at the various strategic points where all nice clothing is supposed to clip and I thing that testimony should be accepted as fairly satisfactory evidence that the gentle process of disintegration known as pineing away to a shadow has not yet made any serious inroads. With these few remarks, which I trust have made my position on the subject reasonably clear I shall refer to the point at issue without any further circumlocution. I like a direct statement either in the printed or spoken form and if there is one class of people more than another with which I have no patience, it is the class which drivels along to the extent of several hundred words where half a dozen would convey their meaning. I like people who have something to say, who know how to say it and who come to the point in a straight-forward businesslike manner.

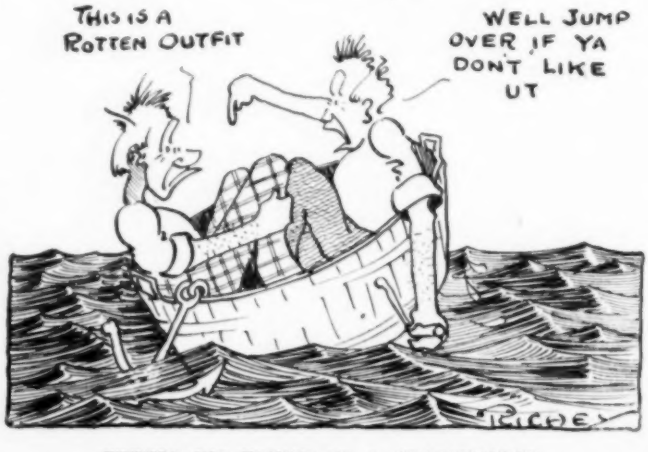
I happened to comment on this subject before a friend of mine the other day and was greatly pleased and mentally fortified to find that he agreed with me absolutely.

"Those gabby birds," said he, "have been my pet abomination as far back as I can remember. We had an instructor in foundry practice in a technical high school with which I was on visiting terms many years ago who was the ultimate and unbearable limit. He had written a list of instructions to cover practically every movement made by the students and as true as I am standing here in front of you ,the list of instructions on how to claywash a gagger filled three foolscap pages."

As I was saying, or at least as I had intended to say—sometimes I am in such a hurry to plunge into a subject that I skip all the preliminaries—as I was saying I always have been more or less puzzled by a peculiar twist in the human mind. Yes, yes, I know what you are going to say. Why use the singular? The human mind is full of twists. I should like to take this point up and debate it, but I am prohibited through a rigid rule I adopted many years ago to follow one thing through at a time.

Adherence to this rule has saved me a great deal of valuable time. Just at the moment I do not recollect in what manner the saved time ultimately was spent, but that is only a trivial detail. Any person can spend time, practically no training is required to qualify as an expert, but any attempt to save it is—Ah! There the skill of the expert is demonstrated.

Any reference to time would be incomplete if it did not include a condemnation of that all too common practice known as killing time. Unfortunately as individuals we can do little or nothing to prevent others from indulging in this shameful practice, but at least there is nothing to prevent us from trying to influence them both by precept and example. With this thought in mind and actuated by a sincere desire to conserve time as fully as possible—you know time and tide



THINKS HIS FRIEND IS A GRASSHOPPER

wait for no man—I shall waste no time in an unnecessary introduction, but set down briefly a question to which up to the present I never have seen a satisfactory answer presented. It may be that you can throw no light on the subject, but at least I shall have the satisfaction of airing my views openly instead of speculating in secret. All open and above board, brief and to the point, that's my method. Hew to the line and let the chips fall where they may. Personally, I think that illustration is slightly out of date, but it is a good old veteran, mellowed with age and tradition and on the spur of the moment I can think of no better simile to convey my meaning. The temptation is strong to go further into the subject, but as I said before I have trained myself over a period of many years to stick closely to one subject and to avoid any reference to even closely related points that possibly might cloud the issue. So many people have an unfortunate habit of rambling all over the map, that I experience a feeling of positive relief when I have the opportunity of taking the floor and stating a proposition or setting forth my views in a minimum number of well chosen words.

Therefore without any unnecessary preamble, which in the last analysis is nothing but a time wasting process I shall set down the question I have in mind. According to the general law of averages I stand about one chance in a million to receive an answer, but I have nothing to lose.

The objection might be raised, in fact I am practically certain that objection actually will be raised in some quarters, that my attitude is entirely too frivolous and therefore my desire for enlightenment either on this or any other question will not be taken seriously. If my suspicion is correct, if no person chooses to—what is the word?—Oh! yes, if no person sees fit to come across with a satisfactory, or for that matter any kind of an answer to the question which I intend to propound, my condition will be rendered no worse than it has been all these years.

Until recently I had given the subject little or no consideration. Occasionally it would flash into my mind, but like the beam from a distant light house it would flash out again without leaving any impression. Last night I picked up one of the discarded school books containing a selection of prose and poetry and in this collection I found a most engaging poem. Not only did I derive a great deal of pleasure from reading the poem over several times, but I also found that it started a train of thought along a certain line to which I have referred several times. The poem dealt in a spirited manner with an episode in the life of an old time highwayman.

ALL PRESENT BUT THE WHEELBARROW

Now the question I want to ask, and I trust you will admit I have wasted no time in leading up to it, is this: Why do we glorify the life and actions of these old time knights of the road and at the same time stand in mortal dread of modern thugs and gunmen?

In fancy we stand the old lads on pedestals with wreaths of holly on their brows while the best we care to assign to the modern product is a seat in an electric chair or a wreath of hemp around their necks.

Poetry influences our opinion but by no stretch of the imagination can we compare a bunch of plug uglies armed with gats in a high powered car to the gallant figure who came riding down the ribbon of moonlight over the purple moor.

"He'd a French cocked hat on his forehead, a bunch of lace at his chin,
"A coat of claret velvet and breeches of brown doeskin;
"They fitted with never a wrinkle; his boots were up to the thigh!
"And he rode with a jeweled twinkle
"His pistol butts a-twinkle,
"His rapier hilt a-twinkle, under the jeweled sky."

There's an entrancing figure for you as he clattered over the cobbles and drew rein under the window of his lady love, the landlord's black eyed daughter who was plaiting a dark red love knot into her long black hair. His brief conversation with the lady is highly romantic and leaves no doubt of his enduring devotion while at the same time skillfully intimating that he is what in these modern materialistic days is known as a good provider.

"One kiss my bonny sweetheart, I'm after a prize tonight,
"But I shall be back with the yellow gold before the morning light.
"Yet, if they press me sharply and harry me through the day,
"Then look for me by moonlight,
"Watch for me by moonlight,
"I'll come to thee by moonlight, though hell should bar the way."

All quite fair and proper, but a jealous suitor betrayed him and a file of King George's red-coated men waited his return. They gagged his sweetheart and bound her standing at the foot of her narrow bed with a musket barrel under her breast. She strained her bonds sufficiently to get her finger on the trigger and then waited until her lover came in sight.

"Her eyes grew wide for a moment; she drew one last deep breath,
"Then her finger moved in the moonlight,
"Her musket shattered the moonlight,
"Shattered her breast in the moonlight and warned him—with her death."

He whirled his horse and escaped temporarily, but a few hours later learned of the tragedy and came tearing back with the white road smoking behind him and his rapier brandished high!

"Blood red were his spurs in the golden noon; wine red was his velvet coat;
"When they shot him down on the highway,
"Down like a dog on the highway,
"And he lay in his blood on the highway, with a bunch of lace at his throat."

Bill came in while I was idly speculating on the subject and since he is a man who has had dealings with various classes of men, including highwaymen, I intimated gently that an expression of opinion would be in order.

"Well," said he, "I'll tell you. I don't know anything about these lads who were accustomed to alternate their periods of billing and cooing with little sticking up exercises. According to my view of the subject a

robbery is a robbery whether the robber wears a cocked hat and a velvet coat; or a dip and a Mackinaw jacket. Giving up one's valuables to a baby with a jeweled rapier is not one whit more pleasant than giving them to a plug equipped with a black jack or a nice hefty length of lead pipe. Speaking personally and without any particular love for King George's red-coated soldiers, I think the lady was silly in hooking up with the bird in the doeskin breeches and the soldiers did a good job in ridding the country of both of them.

"The only kind of highwaymen with whom I am familiar are the cuckoos who maneuver foundrymen into accepting prices for their castings that do not pay for the metal entering their composition. In this modern enlightened age practice of this kind is regarded as legitimate business enterprise and the foundryman has no redress. Quite true he may refuse to accept a contract in which he sees no profit. In that case he finds himself in the same position as the man floating in a tub in the lake. If he does not like the tub he can climb overboard and drown.

"Operation of a foundry presents so many angles that a person could talk on the subject indefinitely. I met my old friend Jim Murphy the other day and he told me of an experience he had about 20 years ago in a foundry in the New York district. It illustrates one of the 1001 reasons why foundrymen tear their hair and never lay away a dime. They are a hard-working, honest, conscientious race of people, but something always happens to afford the well known monkey wrench a chance to insinuate itself among the vital machinery and wreck the apple cart.

"Jim sported a long, graceful moustache in those days and he also enjoyed a reputation of owning an exceedingly long head. He developed and installed many time and labor saving devices that served the double purpose of cutting the cost of producing his castings and alleviating the burden of his trusty henchmen. At the time he had a long order for potash kettles and to facilitate their production he developed a permanent mold rigging which he modestly claims knocked all former methods off the boards, and for that matter never has been improved upon since that time.

"Naturally, he was quite proud of it and anxiously awaited the appearance of the first casting. The job was made in loam, but was so simplified by standard and accurate rigging and appliances that he saw no necessity of placing one of his highly skilled and careful loam molders on the job.

Where were YOU seventeen years ago?

In fact the basic idea was to develop a method within the capacity of the ordinary or garden variety of mud slinger.

"Apparently the mold was made and closed correctly and the symptoms all were favorable during the pouring operation. When the casting was lifted out of the mold on the following afternoon it presented an appearance as round and smooth and slick as an onion. As the crane sailed away down the shop toward the cleaning room, Jim's eyes gleamed with the honest pride of a creative artist whose work justifies his vision. Then something happened that at first caused his eyes to pop and then as he realized the apparently perfect casting was a waster he sent his eyes in a wrathful journey in a search for the man who had made the mold.

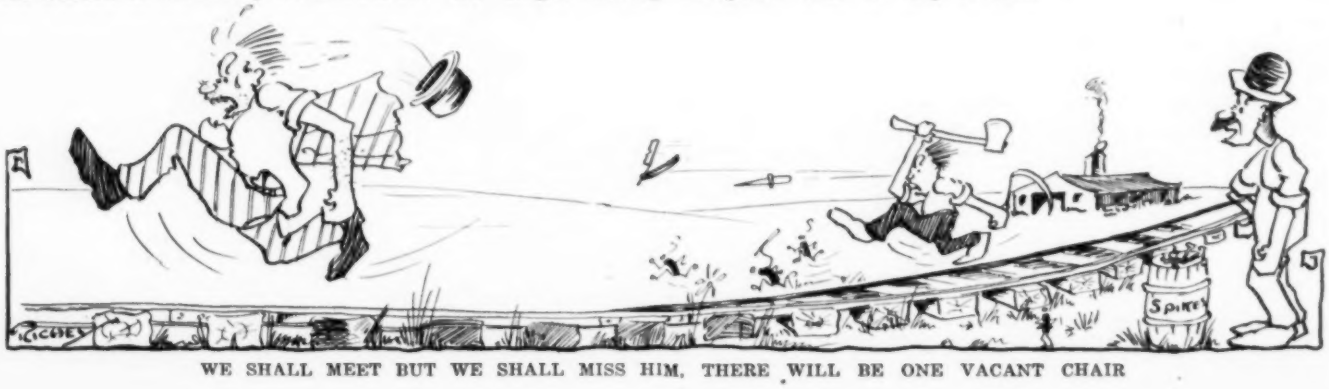
"Before the casting had traveled far on its journey sparks in increasing numbers began to drop from the bottom. Then just as Jim's mind instinctively leaped to the logical conclusion, the bottom of the pot burst into flame and his worst fears were realized. The casting was lowered to the floor where a closer examination showed that the pot was perfect with the single trifling exception that it had no bottom; a positive ruin.

"In telling me of the incident Jim admitted that at the time he was so filled with mixed emotions that he was rendered speechless. Anger predominated at the double distilled density of the workman responsible for the accident. This was closely followed by intense chagrin over the failure of a perfect scheme through a trivial cause, one that never had been anticipated. He declared that his condition exactly duplicated that of another man in a later day and under circumstances that called forth the following opening sentence in a funeral oration: 'Brethren, before us lies the empty shell of a man, the nut has gone.'

"The molder had used a gunny sack partly filled with straw as a resting place on the bottom of the mold for his feet and the foot of a ladder. After he had finished the mold he had climbed out and removed the ladder, but had forgotten the presence of the bag. The mold was closed with the bag of straw in the bottom. The weight of the cope crushed it down flat and formed a solid mass that only was charred around the edge by the molten iron. When the bottom of the casting was exposed to the air on the following day the remainder of the straw caught fire and furnished the shower of sparks that first attracted Jim's attention.

"The lad who made the mold may have been dumb in certain respects, but he showed no lack of promptness after the casting was lifted. He was the first man in the shop to realize the source of the sparks and was up and away with his coat under his arm while Jim was trying to make up his mind whether he should derive more pleasure from massacreing him instantly or grilling him slowly over a 10-ton ladle.

" 'Believe me,' said Jim, 'There was one gay cat who traveled far and who traveled fast. I have done some rambling around in the years that have elapsed since that time, but I neither have seen nor heard of him from that day to this.' "



WE SHALL MEET BUT WE SHALL MISS HIM, THERE WILL BE ONE VACANT CHAIR

Reports Status of Sand Tests-I

By H. Ries

THIS paper presented before Glasgow, Scotland, convention of the Institute of British Foundrymen, June 9-12 is the fifth in a series annually exchanged between that body and the American Foundrymen's association.

BY A curious coincidence the first movement to establish a fund for sand research was inaugerated at the Columbus convention of the American Foundrymen's association 1920 where a resolution also was adopted to exchange papers annually with foreign foundry associations.

THE author of the present paper, Dr. H. Ries is professor of geology, Cornell University, Ithaca, N. Y., where he has carried on the work of sand research to an exhaustive extent. He is a member of the executive committee of the joint committee on molding sand research and also chairman of the sub-committee on tests.

LABORATORY investigation of molding sand is not new. Tests of one sort or another have been tried for a number of years, the fineness test perhaps being the one most commonly applied. Many of these tests have been made according to the individual ideas of the experimenter, but they conformed to no common standard, and consequently lacked a common basis for comparison.

In recent years a strong movement has been in evidence in the United States and in Europe toward a refinement of laboratory test methods, and to their standardization in both countries.

Standard tests enable the consumer to determine the qualities of new sands and intelligently compare them with others already in use; permit the producer to keep a check on the uniformity of his product; make it possible for the consumer to check all shipments as received to determine whether or not they conform to his requirements and specifications; and are of value for daily control in the foundry. While the different tests which we hope eventually will become standardized, may be large in number, all of them will not be used for foundry control. Indeed the number employed for this purpose probably will be limited. Additional tests may serve for the examination of new sands submitted to the consumer by the producer, and still others may be used mainly in research work on sands of various kinds.

Necessity of getting our methods standardized is the most important point. Also, they should be as simple as possible, and the apparatus employed daily in the foundry should be as nearly foolproof as possible, and of a durable nature.

A joint committee on molding sand research acting under the auspices of the American Foundrymen's association, and the engineering division of the National Research council was organized in December, 1921. This committee included not only representatives of the foundry industry, but also one from each of the several technical societies or other scientific organizations which might be interested in such an investigation.

Subcommittees were appointed to take charge of and carry on the several phases of the work: Conservation and reclamation; geological surveys; tests; finance; and publicity.

Tests Adopted For One Year

Development of standard tests had a two fold importance, because they not only were to be used by the foundrymen themselves in their own laboratories, but also were to be used at the testing stations supported by the American Foundrymen's association, where the sand samples collected by the different state geological surveys—to date over 800 samples from 15 states—are being investigated and examined.

Each testing method recommended by the subcommittee on tests is adopted tentatively for one year's trial, to determine by use whether it meets all demands, needs revision, or should be replaced by a better test discovered through various ways during its probation period.

The recommendations thus far made by the subcommittee on tests have been printed in a pamphlet issued by the American Foundrymen's association in June, 1924.

The fineness test as at present recommended by the American Foundrymen's association is essentially a sieve test. For core sands with no clay the sand is sieved dry, but for those sands containing clay substance the sand first is shaken in water to which sodium hydroxide (*Na OH*) has been added, and the so-called clay substance separated from the *grain* by decantation. Test sieves Nos. 6, 12, 20, 40, 70, 100, 140, 200 and 270*[1] are used. Material which passes 270 is caught in the pan. The openings of the No. 270 are 0.053 millimeter and the average diameter of the material remaining in the pan is about 0.035 millimeter.

For purposes of comparison naturally it is imperative that the same sieve sizes should be used in all cases, although even now in the United States this is not done always. Furthermore, it is important that the sieves should be calibrated before use, because even high-priced ones may show variation in the openings for given size.

The diameter of the sieve openings, the diameter of the wires, and the al-

(1) These numbers refer to the United States bureau of standards sieve series.

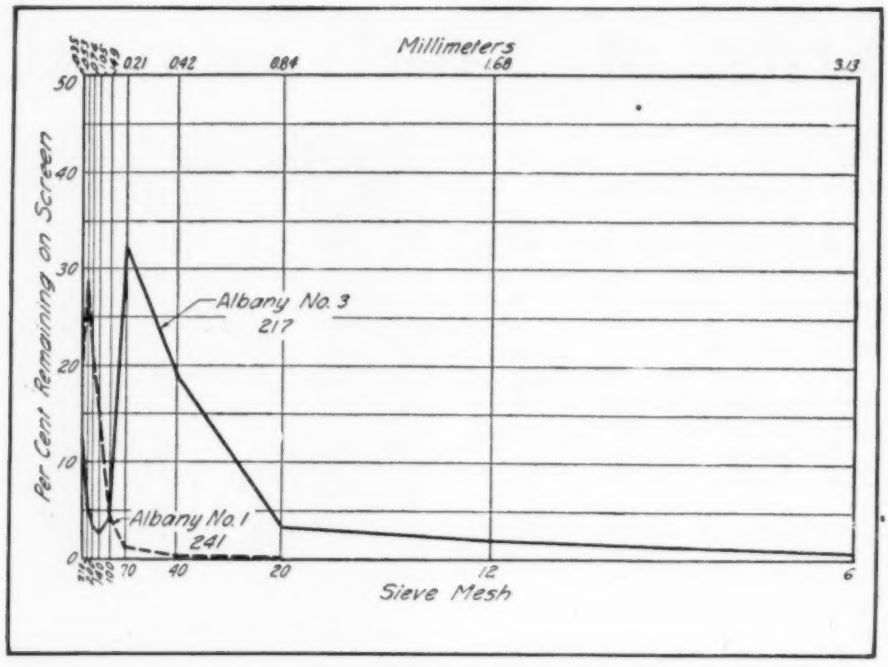


FIG. 1—SIEVE OPENINGS CORRECTLY SPACED ON RECTANGULAR COORDINATES

lowable deviation or tolerance of each from the specified dimensions have been published by the United States bureau of standards.*[2]

That the test works satisfactorily has been shown beyond doubt, and there is no difficulty in obtaining duplicate results which check quite closely if the sand is of uniform character.

Some criticism has been made of the so-called clay substance, which may include both colloidal clay and fine silt and the point has been raised whether for purposes of scientific investigation it might not be well to separate these two constituents. Whether it is essential for general foundry work, is open to discussion.

Another point to be considered perhaps, is the effect of tap water on the process. Water from this source may contain electrolytes, and may vary in its composition. The question then arises, should we test the sand with distilled water. From the foundryman's point of view this may be regarded as decidedly inconvenient and moreover sufficient data are not available to decide whether it is necessary.

The method of determining the texture of the sand is different from that advocated by many foreign investigators and writers, who commonly use the elutriation process, and who regard it as better because as they state it separates the finer sizes. Moreover, they criticise the sieve test, because they claim it does not perform accurate sorting, since large elongated grains might go through the meshes endwise, and hence be caught on the finer sieves to be weighed with the fine particles, in whose company they should not be found.

In this connection I should like to call attention to the following facts. Elongated grains I believe are the exception rather than the rule in most sands: the elutriation method requires considerably more time than the American Foundrymen's association sieve test; the elutriation method requires the use of sieves for the medium and coarser sizes, but the larger sizes separated by water, come within the range of the finer sieve sizes of the American Foundrymen's association test; the American Foundrymen's association method is in actual practical use in foundries in the United States, and is giving satisfactory results; the American Foundrymen's association sieve test separates particles down to 0.035 millimeter diameter; and although I have seen the results of many elutriation tests plotted, I do not remember having seen any practical use made of this extreme separation of the smaller particles.

(2) Revised specifications giving slightly greater tolerance limits were issued by the United States bureau of standards April, 1924.

Fineness Graphs

Having separated sand into its different groups of grain sizes, it is necessary to consider the best manner of expressing the results of these tests. Obviously to record them in tables is the most convenient way, but where a large number of sands are so arranged, a comparison of them is not always a rapid operation. This leads to the possibility of expressing the texture graphically, as by curves or by means of a number.

If we use curves to represent the texture we find ourselves obliged to choose between several methods any one of which may at least be considered fairly satisfactory as shown in Figs. 1-4. Rectangular co-ordinate paper, plotting the percentage of each sieve as ordinates, against the sieve sizes ranged as an abscissas may be used. On such paper the sieve sizes may be plotted at regular intervals and the abscissas representing them may be correctly spaced in proportion to the real size of the screen openings. The first method is used by many, the second by few, and it is open to the objection that the coarser

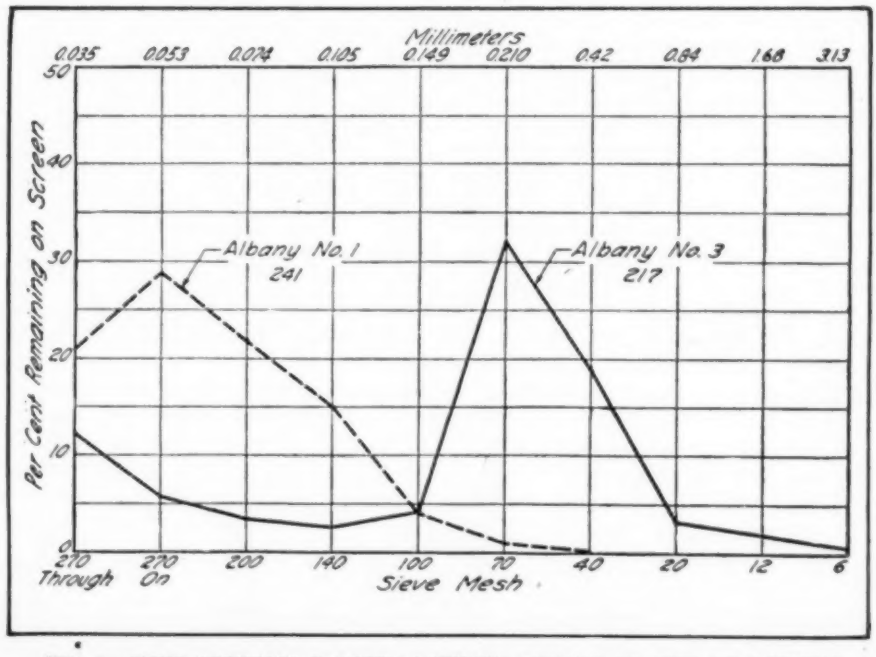


FIG. 2—SIEVE OPENINGS PLOTTED WITHOUT REGARD TO SIZE OF OPENING

sizes take up all the room on the chart, crowding the smaller ones together at one end.

The use of logarithmic co-ordinates for the screen sizes while retaining the rectangular co-ordinates for vertical plotting of percentage retained by each sieve sometimes is followed. If logarithmic co-ordinates are used it seems to be best to plot the size of the actual sieve openings. Two types of curves seem to have been used, regardless of the kind of co-ordinates employed. One of these is the cumulative curve, probably more used in Europe than America. The other gives the actual percentage retained on each sieve. It may be a matter of personal choice which one is used, but to the writer the second of the two seems preferable, because any excess of certain sizes is detected at a glance, although it may be argued that the cumulative curve would also show it by a pronounced local steepening of the line.

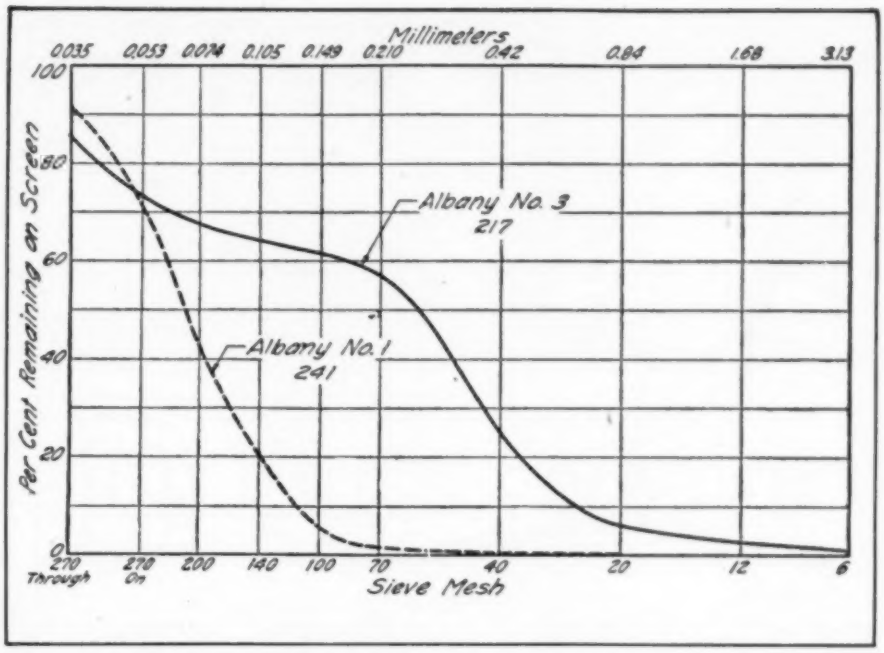


FIG. 4—CUMULATIVE PERCENTAGES WITH SIEVE OPENINGS ON LOGARITHMIC COORDINATES

Fineness Figures

The second method of expressing the fineness is by means of a figure, which we may call the *average fineness figure.*

This can be done in several ways. One, sometimes referred to as the Scranton method consists in multiplying the weight of sand retained on each sieve by the mesh of the next coarser sieve. The sum of these products is divided by 100 and called the average fineness. The objection to this is that sands which differ markedly in their texture, may give almost identical fineness figures as shown in the accompanying table taken from a forthcoming paper by C. M. Nevin.

Metsh	No. 1	No. 2	No. 3
6	0.0	0.10	1.10
12	0.0	1.00	5.03
20	0.02	9.70	9.70
40	0.72	5.76	8.70
70	19.68	19.60	10.60
100	20.18	11.30	11.30
140	14.50	10.56	10.56
200	8.25	9.22	9.22
270	9.46	13.50	13.50
—270 (Pan)	11.40	11.00	12.01
Clay substance	16.70	9.14	9.14
Average fineness	0.98	0.98	0.98

Better results apparently are obtained if we divide the percentage retained on each sieve by the mesh size of that sieve, and take the sum of these, and yet this second method is not without its objections. The first one works best with coarse sands and the second with finer grained ones.

We may question whether such an average fineness figure really shows us as much as a curve, from which the percentage and distribution of the different sized grains can be read at a glance.

Most foundrymen recognize the value of a fineness test. The texture of the sand serves to give an idea of the venting qualities of the material, as well as the smoothness of surface finish which it might produce, unaided by any facing material as well as the approximate size of casting that can be poured in it. It is extremely useful as one of the tests to be applied in checking up new shipments of sand.

In a recent paper before the American Foundrymen's association*[3], C. M. Nevin has presented some suggestive ideas on the grading of sands by means of the fineness tests. His views were worked out in connection with a study of some 60 odd samples of Albany sand. Plotting all these of the same grade on co-ordinate paper, it was found that they agreed quite closely. This permitted drawing what might be called an *average curve.* If now on either side of this we draw two other curves which include most of the variations from the average line, shown by the sands of that grade, and shade the area between these two lines, we get what Nevin suggests calling an *area curve,* Fig. 5. Such area curves were constructed for the different grades of Albany sand. Having the curve plotted, any new sand

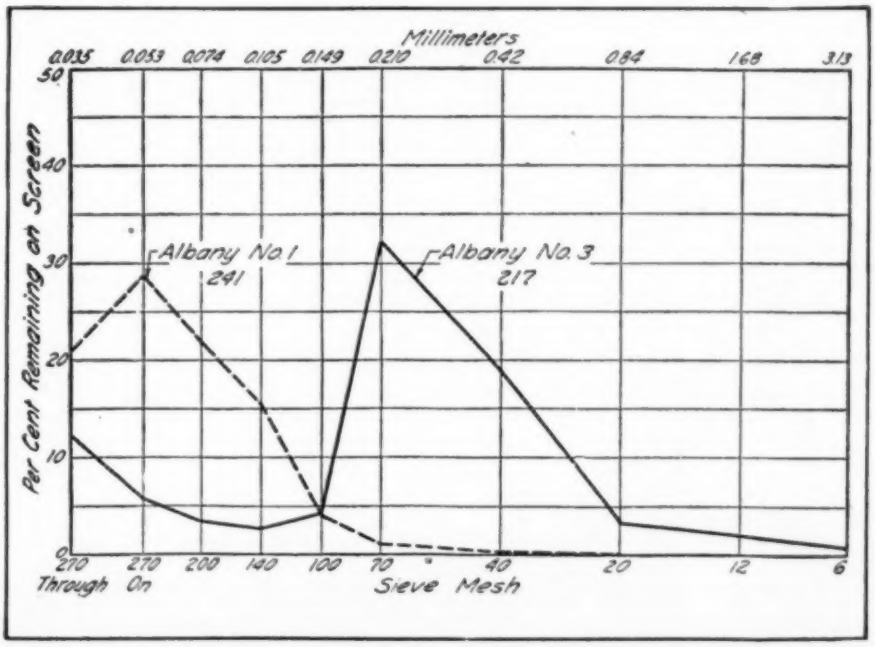


FIG. 3—SIEVE OPENINGS CORRECTLY SPACED ON LOGARITHMIC COORDINATES

(3) *Transactions* American Foundrymen's association, Vol. XXXII, Part 2.

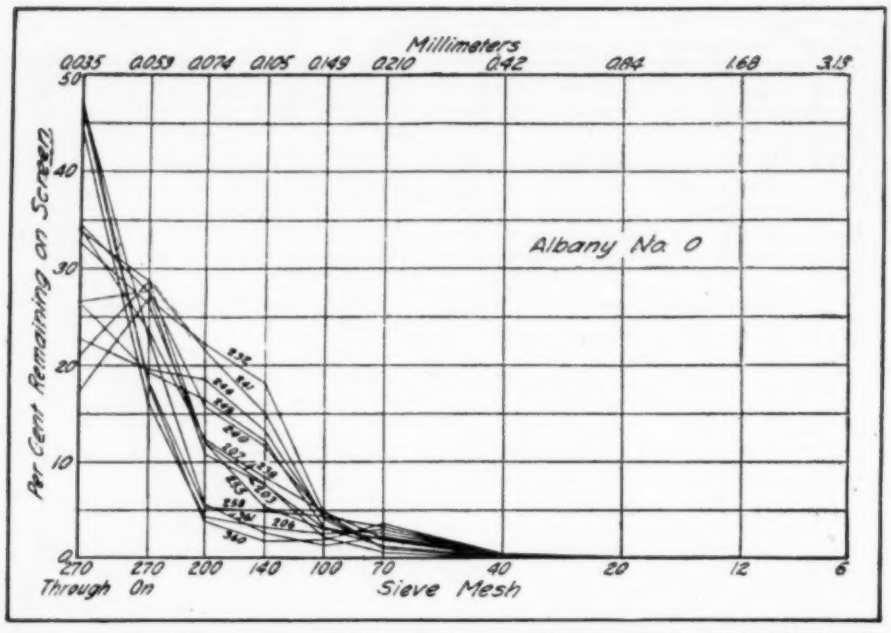


FIG 5-A—AMOUNT OF MATERIAL USED IN ESTABLISHING CHARACTERISTIC CURVE FOR THE GRADE

from that district, can be fitted into its grade. This, of course, refers to texture, and not to any other properties, although permeability is, within certain limits, more or less associated with texture.

To apply the grading theory a little further, let us suppose that some producer in another territory is selling a sand which he designates as No. 6 or 3 *F*, and yet whose fineness curve fits nicely in the area curve of a No. 1 Albany. Why should we not call this a No. 1 sand also? In other words, let us reduce our descriptions to common terms, or the same language. The idea seems attractive to many, and a subcommittee of the American Foundrymen's association has been appointed recently to develop it if possible. If practicable, it is a step toward the development of sand specifications, which may be given out by the consumer to help the producer to supply him with what he wants.

Vibratory Tests

Every industry has its short cut methods for making certain tests, and the foundry industry is no exception. Indeed, as many know, a description of some recently was presented before the French Foundrymen's congress, and in the United States some attention has been attracted to what is known as the Smith vibratory test, and as some rather strong claims have been made for this method, it may not be out of place to devote a few words to it.

Briefly stated, a mass of sand and water are shaken thoroughly by hand in a test tube about 6 inches high and 1 inch in diameter. The suspension is then placed on a vibrator for half an hour, whereupon the grains of different sizes settle to the bottom of the tube, the coarsest on the bottom and the finest on the top, presenting a beautiful series of layers. The thickness of these is measured by a scale, thus obtaining the percentage of the several grades. The layer of finest material is classed as bond. Mr. Smith has sought to show that this one simple test may take the place of all the standard ones used in foundry control, but this does not appear to be the case as the following comparisons taken from a paper by Dietert on foundry control will show.

Nearly all sand showed a larger amount of clay substance. A part of the bond measured in the vibratory test is pan material. The percentage of bond as shown by vibratory test does not enable one to estimate the permeability or strength of the sand. The standard permeability and strength tests can be made much quicker than the vibrating test.

Where the same sand or mixture is being used from day to day, the vibratory test will give an approximate idea of whether it is running uniform or not.

Bonding Strength

Observations thus far made indicate that a general relation exists between texture and permeability.

If we could calculate the permeability from the fineness, it would be convenient. Thus far no one has suggested a satisfactory method, and it seems doubtful whether it can be done.

This we must all admit, is an important property of molding sands, and consequently one for which there should be a satisfactory means of measurement.

I believe it is safe to say that the test for bonding strength and that for permeability, to be referred to later, have thus far received more attention and have had more labor bestowed upon them than any other laboratory investigation methods.

It is not the writer's intention at the present, to discuss the nature of the bond. We acknowledge its presence, and admit that it plays a vital role in strengthening the sand and holding it together in the mold, as well as assisting it to resist the different forces which tend to disrupt it before and even during the process of filling the mold.

There still appears to be some dif-

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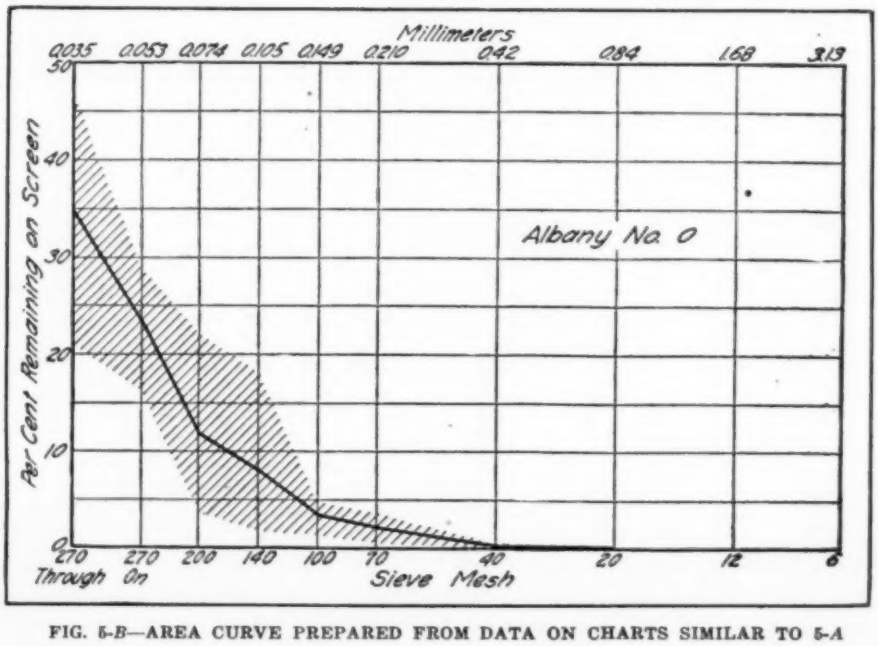
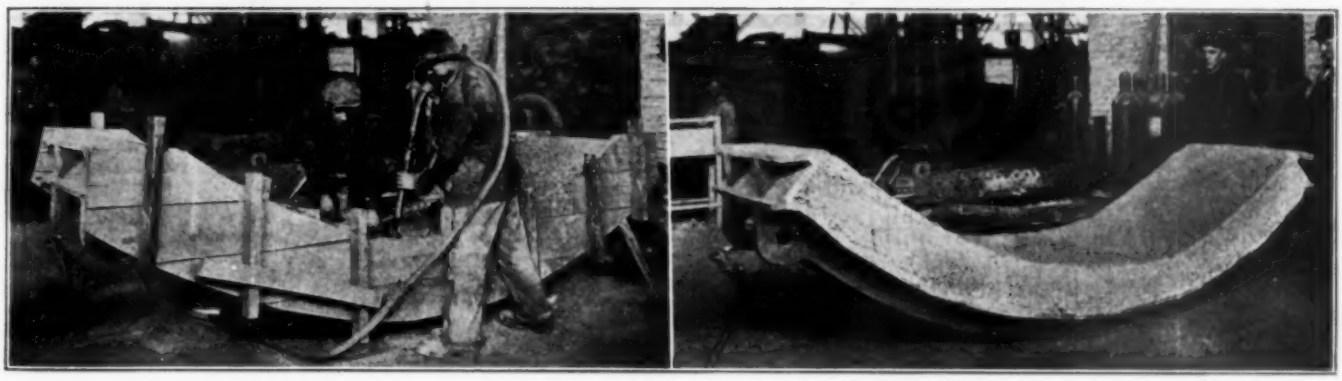


FIG. 5-B—AREA CURVE PREPARED FROM DATA ON CHARTS SIMILAR TO 5-A



Figs. 1 and 2—Method of Ramming and Finishing the Bung

Line Annealing Furnace Bungs

By Meredith F. King

Figs. 3 and 4—Annealing Furnace and Bung Lined With Monolithic Linings

LARGE annealing furnace bungs are used in the plant of the Canadian Steel Foundries, Montreal, Canada. The bung casting has a span of 11 feet 3 inches and is 2 feet 6 inches wide, with a total weight when lined of approximately 6635 pounds. Some time ago the Canadian Steel Foundries adopted monolithic linings in place of fire brick for these bungs, due to the claim of lower cost of refractory material; lower labor cost; and greatly increased service.

The monolithic lining consists of crushed old fire brick bonded with high temperature cement mixed in proportions to make a plastic mixture. This is rammed into the bung casting with an air rammer to a depth of 9 inches, in place of laying up fire brick in these castings to the same depth. A wood form is used as shown in Figs. 1 and 5. This form is made of rough 1-inch stock which is clamped securely with 2 x 4-inch braces against the sides of the casting at appropriate intervals and securely fastened by wire ties drawn tight, as shown in Fig. 5. These forms may be used repeatedly for relining a group of bung castings.

The Canadian Steel Foundries keep a reserve supply of bungs, and as soon as one is out of service, it is relined in the manner described. The newly lined bungs usually are placed for three or four days on top of a core oven for drying, after which they may be handled easily. They then are placed to one side and allowed to air set thoroughly for about three or four weeks. A sufficient number of bung castings are kept on hand so that an ample supply of lined bungs always is available for service.

When lining, the bung is placed in the position shown in Figs. 5 and 6 and the form securely clamped in place. Before ramming in the mix-

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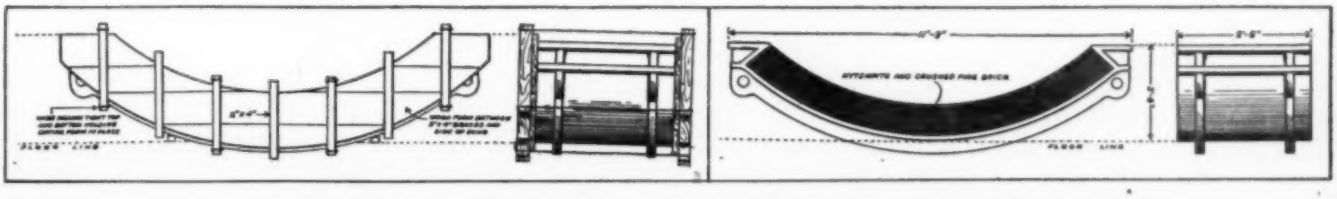


FIG. 5—METHOD OF PREPARING BUNG FOR LINING. FIG 6—BUNG AFTER BEING LINED

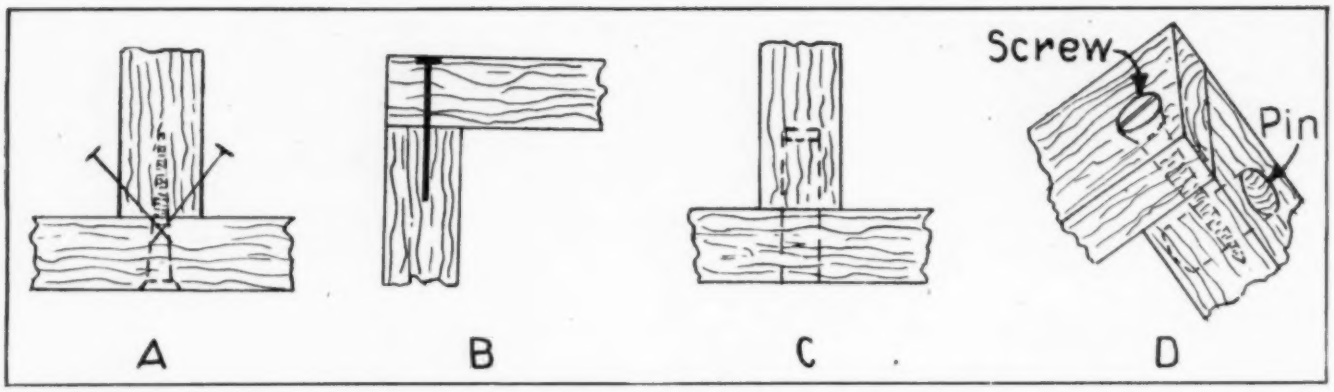


Fig. 1—Toe Nail and Screw, Plain, Doweled, and Pin and Screw Butt Joints

Patterns Gain Strength When *Proper Joints Are Used*

By Walter C. Ewalt

STRENGTH should be the keynote in the design and construction of patterns, since they are called upon to withstand much abuse, if it should thus be termed, including hard rapping in the mold, subjection to heat and cold, wet and dry conditions, rough usage in transporting, careless handling, and conditions present in the construction of the pattern, such as the centrifugal force in turning.

The necessity for good joints is apparent when studies are made to determine the proper methods of holding the different pieces of wood together. Considerable warping, shrinking and swelling must be taken into consideration, as well as the action of joints made of hard and soft woods. At the same time, the patterns should

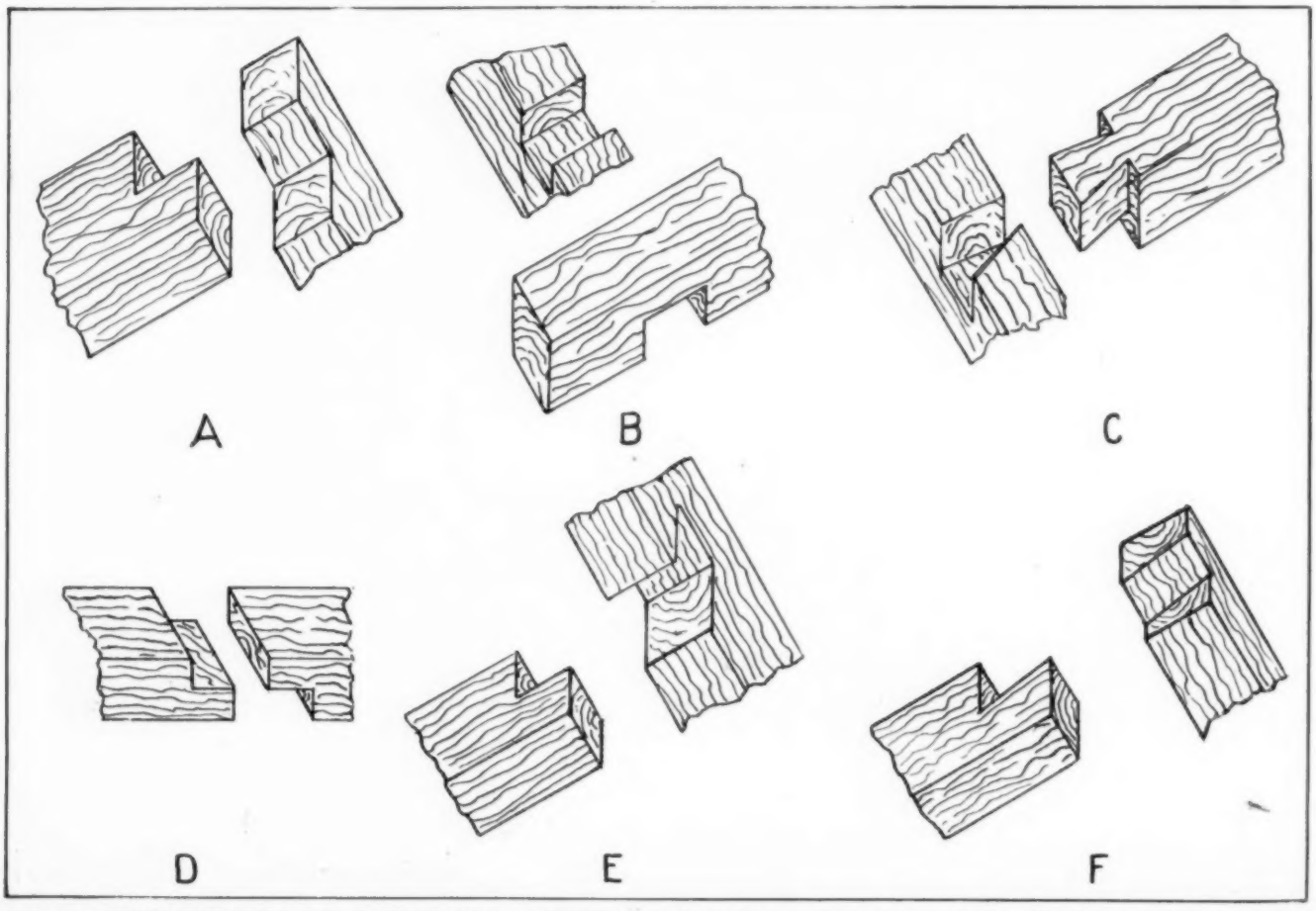


FIG. 2—*A* ANGLE END HALF LAP, *B* CROSS HALF, *C* DOVETAIL HALF LAP, *D* END HALF LAP, *E* MIDDLE HALF LAP, *F* BEVELED HALF LAP JOINTS

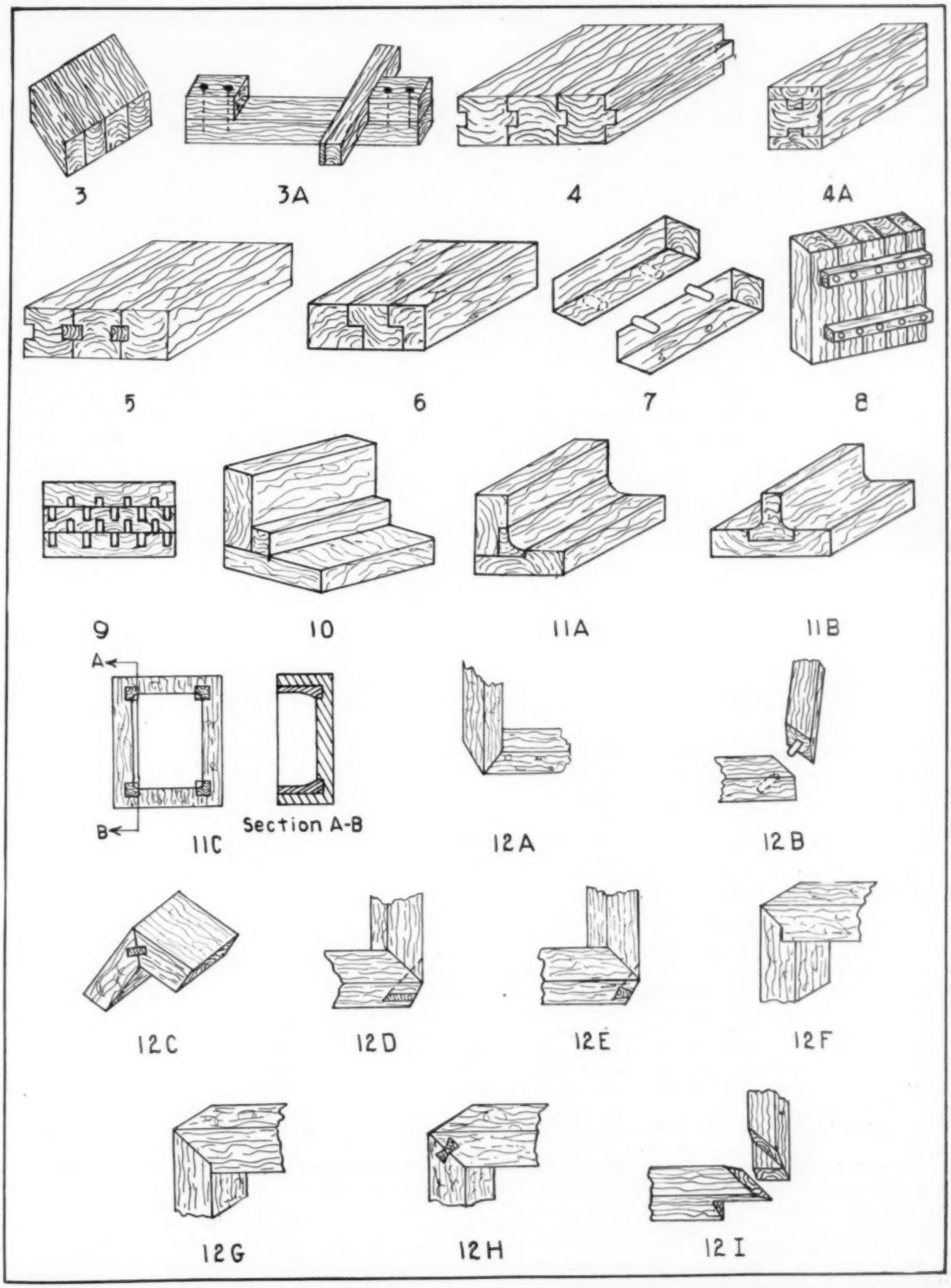


FIG. 3—PLAIN GLUED JOINT. FIG. 3*A*—HOME MADE CLAMP. FIG. 4—MATCHED JOINT. FIG. 4*A*—END TONGUE AND GROOVE. FIG. 5—SPLINE JOINT. FIG. 6—RABBIT JOINT. FIG. 7—DOWELED JOINT. FIG. 8—CLEATED JOINT. FIG. 9—KERFED JOINT. FIG. 10—BLOCKED JOINT. FIG. 11*A*—*B* AND *C*—FILLET JOINTS. FIG. 12—VARIOUS TYPES OF MITER JOINTS, *A* PLAIN, *B* DOWELED, *C* SPLINE, *D* FEATHER, *E* DOVETAL, *F* LIPPED, *G*. STOPPED *H* DOUBLE DOVETAIL, *I* COPED

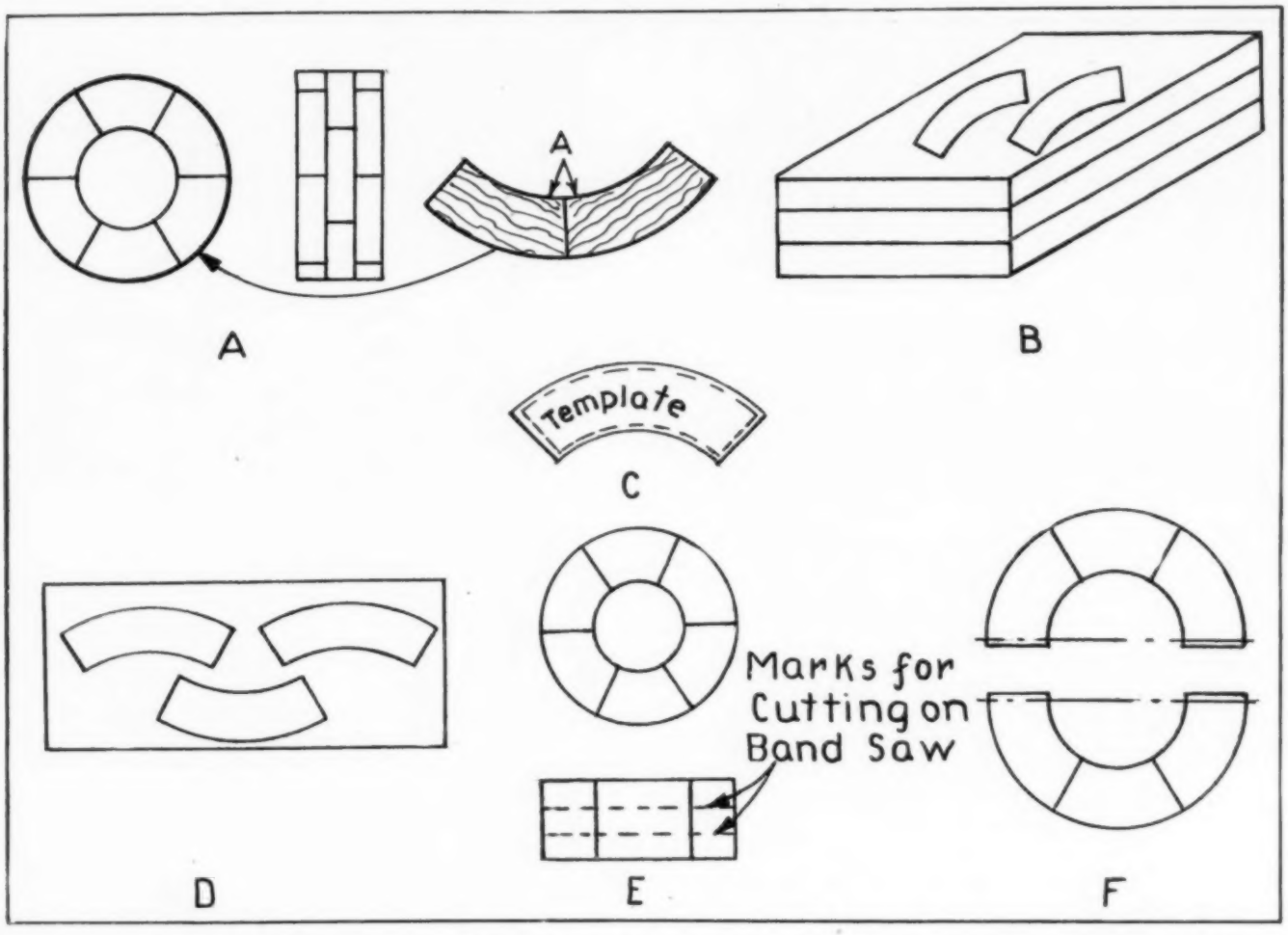


FIG. 13—*A*—SEGMENTAL JOINT. *B*—SAWING A NUMBER OF SEGMENTS AT A TIME. *C*—A TEMPLATE. *D*—SAWING A FEW SEGMENTS. *E*—METHOD OF MARKING FOR CUTTING ON BAND SAW. *F*—GLUING THREE SEGMENTS TO A SET

be made as light as possible consistant with strength. Less lumber often will be required for the patterns if the construction of joints is considered thoroughly.

While it is true that some of the joints described in this article seldom are used in the construction of patterns, a patternmaker often constructs other articles outside of his line of work, and the ideas may be helpful.

A well-made joint must fit. This means that the two or more different pieces of wood should have a close, tight contact. If the contact is not good, it merely is a question of time until the joint becomes open and loose, regardless of whether it is held with glue, nails or screws.

In making joints, one side of the board must be marked *face*, and this side is used to gage and measure all lines necessary to make the joint. Care must be taken to have the face true and straight, as this is the starting point for subsequent operations, and on the accuracy of this face depends the making of a good joint. The series of articles on planes which appeared in THE FOUNDRY, April 1, April 15, May 15, described how accuracy may be obtained in preparing the working face.

Making joints calls for considerable skill, this part of the patternmaker's work being likened to that of a jointer. Various operations are used in doing this work, including sawing, planing, chiseling, tonguing, grooving, rabbiting, mortising, tenoning, boring, graining, pining and dowling, notching, mitering, wedging, lapping and dovetailing. Strength should be considered in every joint and the properties of the woods to be used should be known. A careful study of the glue should be made, this material being discussed in the Aug. 15, 1924 issue of THE FOUNDRY.

Butt Joint Is Simple

The butt joint, one of the simplest and most widely used, is shown in Fig. 1, *A*, *B*, *C* and *D*. In each of these types, glue should be used to add strength. Fig. 1, *A*, shows a toenailed, butt joint, the nails being driven diagonally through the corner of one piece into the other. Screws often are used in place of nails, a hole being bored in the lower member the size of the screw, the screw running into the upper as shown. The plain butt joint which is fastened either with nails or screws, is shown in *B*, while a strengthened joint fastened by dowels is shown at *C*. A stronger plain butt joint is shown at *D*. A hole is bored through the side of the member a short distance back from the joint hole, and a short wood pin, which has the grain running in the opposite direction, is inserted and glued. The screw then is run through the dowel. The joints illustrated at *A* and *C* are used on ribs, etc., and *B* and *D* in patterns of box like form.

The joints in Fig. 2 are called halved joints because one half of the thickness of each board is notched out so that both top and bottom surfaces are even or flush. This joint is used often in making core frames, foundation frames for patterns, joining of branches, etc. In laying out these joints, the members usually are made the same thickness and one member is laid across the other and marked along the sides. This method is called superposition and is a quicker and better way of measuring. The member marked then is gaged to half the thickness and lines are drawn across

both edges square with the face and from lines marked on the face from the other member. When the two pieces are put together, the top and bottom are flush. In the angle end lap, which is shown in Fig. 2, *A*, the ends are halved and the members are at some angle to each other. The joint shown in Fig. 2, *B*, is called a cross lap, the members crossing one another at some angle and projecting some distance away from the joint. A strong joint called the dovetail lap, is shown in *C*. The dovetail tenon, which is made first, is laid on the other member and marked. This method is easier than making the dovetail groove first and making the tenon last. The end lap, which is used to extend the length of the board, is shown in Fig. 2, *D*. The middle lap, shown at *E*, is similar to the cross lap, except one member does not extend across the other. A beveled lap, which may be applied to any of the previously mentioned half laps, is illustrated in Fig. 2, *F*. This is a stronger lap than any which have been mentioned, with the exception of the dovetail lap shown at *C*, or the cross lap, *D*, since this joint not only is held with glue and screws, but also by the wood itself, which is made in such a shape to prevent pulling apart if held down with sufficient weight.

Rings Should Alternate

A plain glued joint is shown in Fig. 3. Care should be taken in making this joint to see that the rings, which may be seen at the ends of the boards, alternate in directions to prevent warping. If possible, the grain should run in the same direction on the surface. This will make the surface much easier to plane, since there will be no cross grain encountered. Two or three ways of gluing this joint may be used, namely rubbing, clamping and dogging. The edges to be glued not only should be square with the sides, but also true planes, when making rubbing joints. However, the joint may be well made if the edges are not true planes, providing the surfaces meet at all points. Nevertheless, it is easier to make a good joint if the planes are true. The edges may be made true on the surface table with the chalk method, or the winding sticks or straight edge may be used. When the joints are made in this manner, the first board is placed in a vise with the jointed edges up. The next board is placed upon it and is tested by noticing whether there is any rocking motion when one end of the board is pressed down. If a rocking motion is found, it shows that the middle of the joint is high and must be planed. On the other hand the center of the joint may be open, and rocking will not occur. An opening at the middle may be noted by determining whether light shows through the joint. A piece of paper may be passed through to determine how much must be taken off at the ends of the joint.

After the joint is perfect and the surface a true plane, the joint edges are spread with glue and rubbed back and forth lengthwise to remove the surplus glue. As the glue starts to set, the boards are moved to their correct position. During this time the joints are not separated, for air striking the glue chills and prevents the glue from spreading easily.

With one exception, the same operation is employed when using clamps or dogs. When long boards are glued together, the joints are made concave, so that the ends of the boards which shrink faster than the centers, will not open. Gluing one joint at a time is a slow operation when more than one joint is to be glued, as it takes some hours for the glue to dry. Speed may be made by using long clamps or clamps made from lumber 2 x 4 inches with a short piece of the same material screwed to each end. Two wedges are used to clamp the boards together after the glue is spread. This type of clamp is shown in Fig. 3, *A*.

A matched joint is shown in Fig. 4, an end tongue and groove joint in Fig. 4, *A*, a spline joint in Fig. 5, and a rabbet joint in Fig. 6. If glued, the tongues keep the members from becoming crooked and make a stronger joint. This type of joint is not glued in some patterns to allow for shrinkage or swelling, for example when used with a segmental ring or cleat fastened on each end. This also applies to the doweled joint shown in Fig. 7. The dowels in this type of joint may be measured for position or they may be located by driving a brad up to the head in one board, placing the other board over the first and pressing down. The holes are bored and countersunk slightly. The pins are made of equal length and cut about 1/16-inch shorter than the total length of the holes in each board. For example, if the holes in each board are ¾-inch deep, the pin should be 1 7/16 inches. A small groove is cut lengthwise in each pin to care for any surplus glue which otherwise might prevent a close joint. Glue is spread on the edges of the boards and the pins dipped in the glue, the pins placed in the holes and the joint clamped.

The cleated joint, shown in Fig. 8, is in common use. This consists of a plain joint with cleated boards screwed on one side to keep the surface straight. Often the holes for the screws are slotted and iron washers are placed under the heads of the screws. This practice allows the boards to move when swelling or shrinking, and still keeps the surface straight. A method of gluing boards which sometimes is practiced with especially large boards, is shown in Fig. 9. This is called a *kerfed* joint. A number of saw cuts are made lengthwise about half the thickness of the board. This reduces the tendency of the combined pieces to warp. The kerfs should be plugged at the ends to keep the air from the interior, or when sawing, the kerfs may be stopped about an inch from the ends.

A block joint, which is used often to strengthen the corners of patterns and coreboxes, is shown in Fig. 10. A few fillet joints are shown in Fig. 11, *A*, *B* and *C*. These may suggest many similar joints which may be used in constructing patterns and coreboxes. A plain miter joint, which often is used, is shown in Fig. 12, *A*, some modifications of this joint being made to obtain strength. The doweled miter is shown at Fig. 12, *B*, the spline miter at *C*, the slip feather miter at *D*, the slip, dovetail miter at *E*, the ledge and miter at *F*, the stopped miter at *G*, the double dovetail miter at *H*, and a coped miter at *I*. A beveled joint at an angle of 45 degrees is called a miter, although any of these joints may be made at different angles. This is not considered a strong joint, but if shrinkage occurs, it will take place on the inside while the outside remains tight. In some cases the miter has an advantage over other types of joints since no end grain shows. The miter joints are nailed, screwed, glued and fastened together by the means under which they are known and shown in the accompanying illustrations.

Made of Segmental Joints

The dowel miter has a round which enters into each member. The spline is a narrow piece of wood which runs in the opposite direction to the members. The feather is a narrow strip of wood fitting a saw kerf. The dovetail is slipped into place and then glued. The stopped miter was boards of unequal widths.

Segmental joints are shown in Fig. 13. Many patterns of ring shape are made in this manner, which undoubtedly is the best way to make the ring when strength is desired. Flanges, rims of pulleys, cylinders, piston rings, engine heads and countless other patterns of a like nature are made in

this manner. Alternating the joints, running the grain lengthwise and following the outline of the pattern, gives strength and allows the material to be turned nicely on the lathe. Practically all of the surface is with the grain. However, if a smooth job is desired on the interior, the joints must be tight. Otherwise some of the short lengths of grain will be broken, due to the next segment not giving a solid backing. This feature is shown at Fig. 13, *A*. Each complete circle segment is called a course. Three or more courses should be used in making the pattern, this procedure being termed building up, while the pattern is called a built up pattern. If less than three segments are used, difficulty will be encountered in keeping the pattern straight. The number of courses depends on the thickness of the pattern and the layout.

Four segments are sufficient in small patterns up to 6 or 8 inches, in diameter, while for larger patterns there should be 6, 8 and 10 or more to the course, depending on the size of the pattern. It readily may be seen that if only four pieces are placed in a course of larger diameter, more end grain will be encountered in turning and the corners may break. After the size, thickness and number of segments are determined, a templet is made of cardboard or wood. The lumber is dressed to the correct thickness and marked, using the templet. The boards are sawed off slightly longer than the segment and stock is left on both inside and outside for turning. The pieces are spotted in a few places with glue, piled on one another and the glue is allowed to set, as shown in Fig. 13, *B*. The templet then is placed on top and used as a guide for marking. The pieces are sawed with a bandsaw, the line being followed closely, and then are pried apart. If only a few segments are to be made, they are marked as shown in Fig. 13, *D*. When extremely thin segments are desired, a course is built of thick lumber, and after the glue has set, the course is split with a band saw, as illustrated at *E*. The middle course is turned upside down and the three courses are glued together, care being taken to have the joints of one course come midway between the joints of other courses.

Rings may be built up on the face plate of the lathe. The face plate first is trued and the center found. A small piece of zinc is nailed at the center and the center marked on the zinc. This strip of metal prevents the dividers or the trammel points from enlarging and making the center hole off to one side. The inside and outside circle the size of the ring are struck on the plate. The segments are laid out and the joint lines, which are the radial lines, are struck to the center. Paper 2 or 3 inches wide is glued on the radial lines extending on both sides of it, the first course being glued to this paper. This course then is fastened to the face plate with screws from the back of the plate. After the glue sets, this course is faced off and another course glued upon it. This procedure is continued until the courses are glued together.

Canada was attractive then as it is now.

This course is successfully employed for large rings having a diameter of 4 feet or more, but a quicker and cheaper method is used for smaller rings. The tools used are the band saw and surface grinder and an iron surface plate or a number of small ones. The iron plate is best for the glue will not stick to it. After the segments have been ground to the line as previously mentioned, the ends are ground close to the lines. The work need not be exact, since the segments are glued together as shown in Fig. 13, *F*. The remainder of the segments are glued in the same manner. After the last segments are glued, the first three have set sufficiently to be ground across the center line shown in Fig. 13, *F* at *C*. The other sets of three are ground across the center line in the same way. The sets then are glued at the center line, using the surface plate as before. The semicircles are sawed before final gluing, if thin segments are desired. After the glue has set sufficiently to allow the course to be handled, the surplus glue is scrapped off and the courses ground straight or planed The courses are glued together and clamped, care being taken to have the joints alternate. If half circles are wanted for split patterns, after being clamped for 3 or 4 hours, the ring may be sawed and ground across the center. Sufficient stock must be allowed to provide for turning the outside diameter equal to the saw cut and the amount ground, or about ⅛ or 3/16 inch.

Henry Disston & Sons, Inc., manufacturer of saws, tools, files, knives, and steel, has purchased a new and more commodious building in Chicago at 111-115 North Jefferson street.

Line Annealing Furnace Bungs

(*Concluded from Page* 535)

ture, the interior face of the bung casting is painted with a batter of high temperature cement which bonds the rammed-in mixture to the casting. The refractory material used, is crushed old fire brick reduced to approximately ¼-inch mesh, including the fines. This material is put in a cement mixer in proportions of 3000 pounds of crushed fire brick to 1000 pounds of cement. To each batch of this size a half bag of portland cement is added when the mixture is almost ready for ramming.

The mixture is dumped between the sides of the form to a depth of about 4 inches. This material is rammed, using an air sand rammer 1⅛ inches in diameter and having a 9-inch stroke, built by the Ingersoll-Rand Co., New York. Ramming is not done directly on the material, but against a piece of board which is shifted about to get an even distribution of pressure. More material then is dumped in until the desired lining thickness of 9 inches has been reached.

It has been found that with the monolithic lining, three men can ram four bungs in a day. It is stated the majority of the bungs lined by this method have been good for 30 heats of service.

The bung with form for ramming attached is shown in Fig. 5 while the finished bung with the form removed is illustrated in Fig. 6. Fig. 1 and 2 show the method of ramming and the finished bung. Fig. 3 is a general view of the annealing furnaces and shows the method of placing a bung on the furnace. This particular bung has been used about 15 times, but the lining still is in good condition. Fig. 4 shows a smaller bung lined with the same materials used on a manganese furnace for crucible melting. In the left back ground the roof of the furnace in operation may be seen.

Properties of the Burton-Townsend Brick Co. of Zanesville, O., have been taken over by J. L. Murphy of the Hocking Valley Brick Co., Logan, O., the Metropolitan Paving Brick Co., Canton, O., R. L. Beck of the Cleveland Brick & Clay Co., Cleveland, and E. M. Ayers, Ayers Mineral Co., Zanesville. The new company is to be known as the Zanesville Clay Products Co. Molding sand is one of the commodities marketed by the company.

Milestones in Foundry Progress

As Recorded in the July Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

WILLIAM SELLERS & CO. had constructed a new foundry in Philadelphia. This was described in the July, 1895 issue of THE FOUNDRY. Particular mention was made of the heating system which employed exhaust steam and also of *interchangeable* cast iron flasks.

* * *

Arrangements had been completed with W. J. Keep, Detroit to answer questions and write frequent articles on cast iron.

* * *

A cost system is a map; without one you may land at your destination all right, but if you do in these days of rivalry, it is a lucky star that is guiding you. Many a firm can trace their failure directly to the neglect of keeping a cost system.

KRANK'S KORNER.

* * *

About this time the popular tunes of the day were Ta-ra-ra-Boom-Dee-A and a soulful dirge about a ship without a sail and a shirt without a cost system. Remember 'em?

* * *

A. Sorge, Jr. and G. M. Sargent, Chicago, engaged in a debate at a meeting of the Western Foundrymen's association on "Resolved—That the Cavities Were Caused by Occluded Gases." The decision was not awarded to either contestant.

* * *

Henry Hansen discussed the mutual relationship of the foundry and machine shop. He said that the door separating these two departments closed in many places too tightly and that the hinges needed oiling.

* * *

Speaking of hinge oil, Frederick the Great, Berlin, it is said, was much enraged one day when his second assistant brewmaster reported that the cast screw on his largest malt press had broken. He sent for the foundryman and for the machine shop foreman who had handled the job, stating that the one at fault should pay for the entire lot of boch beer which was lost through the accident. The machine shop foreman said that the casting was defective, but the foundryman swore that the screw pitch was machined wrong. Thus originated the expression, PASSING THE BOCH.

* * *

Pig iron was selling at $12.25 to $12.50 a ton, Pittsburgh. Copper was quoted at 10½ cents and pig tin at 15 to 16 cents.

* * *

The Plumbago club met in the city hall at Detroit and denounced a stranger who was selling *talk* or *talc* for facing.

* * *

Isn't talc still used as a flapper facing?

* * *

The Birmingham, England, foundry in which James Watt worked out his idea of the steam engine was being demolished after an active life of 133 years.

Faked Foundry Facts

Daubing Up

NEW YORK was the meeting place of the American Foundrymen's association convention on June 6-8, 1905. Chris J. Wolff was president and Richard Moldenke, secretary. Insurance companies had an agreement to pay only 10 per cent of valuation for patterns destroyed by fire. Frederick Conlin, Bethlehem, Pa., was chairman of a committee appointed to correct this injustice.

* * *

A cartoonist who was too modest to sign his name, covered the convention for THE FOUNDRY and his depiction of W. J. Keep, Dr. Moldenke, W. G. Jones, L. G. Blunt and others is thrilling.

* * *

Apparently some of the gentlemen, whose names were not given, were Mr. Bush, Mr. Beaver, Mr. Van Dyke, Mr. Burnsides and Mr. Spinach. Gillet had not yet made his razor safe enough. Each of the ladies shown wore a round turned up hat surmounting a mysteriously constructed pompadour and their ears were shamelessly exposed!

* * *

H. E. Diller, Western Electric Co., Chicago, later for many years metallurgical editor of THE FOUNDRY submitted a report on determining silicon in cast iron. He also recommended more work on the question of carbon.

* * *

Mr. Diller's thoughts on these subjects were in advance of the day and later became generally accepted.

* * *

Thomas D. West was elected president of the association.

* * *

No. 2 pig iron was bringing $15 a ton, valley. Foundries were carrying only small stocks and rush orders for iron were frequent.

METHODS for making boiler and greenhouse castings in gray iron were described by E. C. Kreutzberg in the July, 1915 issue of THE FOUNDRY. The plants mentioned were H. B. Smith Co., Westfield, Mass. and Lord & Burnham Co., Irvington, N. J. A roller ramming machine was used for long gutter castings.

* * *

Tentative specifications as proposed by the American Society for Testing Materials were given.

(*Concluded on Page* 547)

The Shakeout

DAN M. AVEY, Managing Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶Apprenticeship Is Reviving

FOUNDRYMEN who have been viewing the vanishing apprentice with a pessimistic eye in recent years will be heartened by a report from a prominent plant in the middle west where nine young men recently were graduated with appropriate ceremonies as journeymen molders. They were indentured in a formal manner three years ago and were advanced steadily from the simplest to the most complicated classes of castings. This represents a radical departure from the practice prevailing during the past 20 or 30 years, where boys were regarded merely as cogs in the industrial machine to be exploited to the limit. A boy was taught to make one job and then as he developed speed and skill, he was kept on doing a man's work for a boy's pay.

THIS condition did not prevail in all cases, but it is one of the principle causes responsible for the distaste of boys to learn a trade. The average boy is eager to learn and given proper encouragement will co-operate heartily with his teacher. He also has an innate sense of justice and resents just as bitterly as any grown man any attempt to take advantage of him either on account of his youth or his position in the so called social or industrial scale.

In many respects conditions in the foundry are different from those which prevailed in olden times, but from the foregoing example and others which have come to light in the past year or two, it would seem that where apprentices are taken in with the specific understanding that they will be taught a trade properly, they may be secured as readily as in an earlier day.

¶Youth Is Handicapped

THIS is the season when the confident young graduate steps out of the classic halls of learning where he has been sheltered for several years. He has pursued his studies under the most congenial conditions and has been associated with contemporaries whose past experience and future outlook are on a par with his own. He has been free to follow his own ideas and to put forward theories based on what he has seen, heard and read and if he has met opposition it has been from those whose mental equipment equaled his own. He looks on his fellows with the utmost faith and confidence as good old sports all pulling together for the greater honor and prestige of the institution. Stepping out of such an atmosphere, naturally some time must elapse before he can adjust himself to the hard old realities of life. Warriors who have borne the heat and the burden of the day, might keep this point in view. It will help them to deal tolerently with mistakes incident to the enthusiasm and inexperience of youth.

¶Production Seeks Normal Level

AFTER establishing a record in 1923, steel casting production declined in 1924, as is shown by figures compiled by the American Iron & Steel institute. The total output of steel castings for the past year was 1,120,782 gross tons, which, when contrasted with the production of the previous year, shows a loss of approximately 23 per cent. However, the output for 1924 ranks well with the records of other years, a better basis of comparison being afforded by comparing the 1924 output with the average of several years. In the war period from 1915 to 1918, the average production was only 1,271,851 tons, although tremendous demands were placed on the capacity of the country. In the period from 1919 to 1924, the average output was 1,066,830 tons, this period including the prosperous times immediately after the close of the war and the depression of 1921. The output in 1924 was exceeded only two times in this six year period, in 1920 when the production was 1,251,542 tons and in the record year of 1923 when 1,458,031 tons were produced.

LOSSES in 1924 compared with previous years are reported in all classes of castings, the greatest decline being in acid open-hearth castings. Open-hearth castings produced in 1924 totaled 859,419 tons as compared with 1,152,609 tons in 1923, or a loss of 25 per cent. Basic open-hearth output was 456,518 tons, a loss of 20 per cent, while the acid production showed a loss of 31 per cent with an output of 402,901 tons. Basic open-hearth production again has taken the lead, exceeding the acid production by 53,617 tons.

Bessemer steel castings totaled 53,437 tons, a loss of 21.5 per cent. With the exception of 1921, the production last year was the lowest in the 15 years that the production records have been kept. Crucible steel castings production stood second in point of greatest loss, the output being 1377 tons or 29 per cent less than in the previous year. The healthiest condition is shown in the production of electric furnace castings where the output was 206,449 tons and the loss only 12.5 per cent.

Trade Outlook in the Foundry Industry

SENTIMENT and buying in the iron and steel market after having swung from high to low points, are assuming more rational proportions. Within a period of six months the market has passed through an interval of heavy buying with high expectations followed by one of contracted purchasing and depressed sentiment. Apparently neither attitude has reflected the underlying conditions of consumption correctly. They have been and remain favorable and sound. The real fundamentals of the situation seemingly have begun to assert themselves with the result that confidence is showing signs of being restored and preparations for business are proceeding along prudent and more normal lines.

Revival of Interest

Heavy production of iron and steel for the first quarter, the largest for any similar period on record, to all indications has taken care of the margin of over buying of steel generally done for the first quarter. In April the country was making pig iron at the rate of 38,200,000 tons per year as compared with a rate of 42,200,000 tons in March. Furnaces in blast at the end of April had dropped to 221 as against a high point of 256 at the end of February. Further curtailment in both iron and steel production is taking place, but the fluctuations in total production are nearing a balance. Revival of buying and of interest in the market by consumers now is growing. Heavy shipments taken during the first three or four months have been well worked off or definitely assigned for use. Faith has been recovering and prices have been becoming more attractive. During the past month the decline in iron and steel prices has gone further, amounting on the whole to approximately $1 to $2 a ton. *Iron Trade Review* composite of fourteen leading iron and steel products which stood at $39.43 as of April 15 was $38.21 the third week in May.

Prices for Raw Materials for Foundry Use

CORRECTED TO JUNE 23

Iron		Scrap	
No. 2 foundry, Valley	$18.00	Heavy melting steel, Valley	$17.00 to 17.26
No. 2 southern, Birmingham	18.00 to 20.00	Heavy melting steel, Pitts.	17.00 to 17.50
No. 2 foundry, Chicago	20.50 to 21.00	Heavy melting steel, Chicago	15.50 to 16.00
No. 2 foundry, Philadelphia	21.25 to 21.75	Stove plate, Chicago	15.75 to 16.25
No. 2 foundry, Buffalo	19.00 to 19.50	No. 1 cast, Chicago	19.50 to 20.00
Basic, Valley	18.00	No. 1 cast, Philadelphia	17.50 to 18.00
Basic, Buffalo	18.50 to 19.00	No. 1 cast, Birmingham	16.50 to 17.00
Malleable, Chicago	20.00 to 20.50	No. 1 cast, Buffalo	16.00 to 16.25
Malleable Buffalo	19.00 to 19.50	Car wheels, iron, Pittsburgh	16.00 to 16.50
Coke		Car wheels, iron, Chicago	17.50 to 18.00
Connellsville foundry, coke	$3.75 to 4.25	Railroad malleable, Chicago	18.00 to 18.50
Wise County foundry, coke	4.50 to 5.25	Agricultural, mal., Chicago	17.00 to 17.50
		Malleable, Buffalo	17.50 to 18.00

Well Above Normal

This is the season at which business usually begins to slow down. Among the major industries now operated at the lower rates are iron and steel, coal and railroad equipment. Among those which are doing best are building construction, rail and water transportation, manufacture of automobiles, and the making of farm implements. Despite the fact that current statistical reports indicate that general business is going forward at levels, well above the theoretical normal, many expressions of disappointment on the part of business men continue to appear in the financial reviews. Probably the reason for this is that business men have become accustomed during the past 10 years to the sharp advances in commodity prices that characterized the war time activities, the post war boom and the recovery following the depression of 1921, but which have not accompanied the present period of good business. Industrial profits increase during periods of rapidly advancing commodity prices and make profits easy to earn.

Heavy Iron Buying

The impressive pig iron buying movement which has totaled approximately 1,000,000 tons for third quarter delivery has lent a firmer tone to the pig iron market. It is estimated that fully 18,000 tons of pig iron have been sold in New York in the past few days, some for outside consumption. The Burnham Boiler Corp., bought 2000 tons, the Connecticut Foundry Co., bought 2000 tons, No. 1 foundry and the Baird Machine Co. took 500 tons of the same grade. The New York Air Brake Co. has postponed closing on its inquiry for 2500 tons. The Crane Co., Bridgeport, Conn., is inquiring for an indefinite tonnage. Volume of new inquiry is comparatively small aggregating 3000 to 5000 tons. In Chicago the demand for Northern No. 2 foundry and malleable pig iron continues heavy although somewhat under the total of the first part of the month. One selling interest claims to have booked more business in the past 10 days than in any 10 days in its history. New pig iron inquiries in the Buffalo district aggregate 5000 to 7000 tons in lots of from 100 to 1000 tons. Recent pig iron sales in Philadelphia total at least 15,000 tons. The Standard Sanitary Manufacturing Co. bought 5000 tons for its Baltimore plant. Another melter bought several thousand tons of foundry iron and numerous others bought smaller lots, all for third quarter delivery. Rumors of price cutting have been declared unfounded.

Cast Pipe Is Active

The department of commerce announces May bookings of steel castings based on reports from principal manufacturers, representing over two thirds of the commercial-castings capacity of the United States, as 49,619 tons or 49.4 per cent of the total shop capacity as against 59,008 tons in April or 58.8 per cent of plant capacity. Cast iron pipe tonnage has been fairly active. Detroit has awarded a contract to the United States Cast Iron Pipe & Foundry Co., for 14,267 tons of which a considerable proportion is centrifugal cast. Bids will be received until July 20 by the local department of water supply, gas and electricity. New York, for 5000 tons.

Personal

JAMES LINKLATER, who recently resigned as superintendent of the Michigan Malleable Iron Co., Detroit, was connected with the International Harvester Co. at its Chicago and Hamilton, Ont., plants for 15 years before going to the Detroit company, where he served for 12 years. Mr. Linklater will take an extended vacation before going into business.

David Teeham has been appointed foreman of the Howard Stove & Furnace Co., Ralston, Neb. Mr. Teehan

JAMES LINKLATER

served his apprenticeship in Fulton, Ill., and recently has worked in several shops in the East.

A. V. Ruggles, for 11 years connected with the water department of Cleveland, and for the last few years commissioner of water, has become connected with the United States Cast Iron Pipe & Foundry Co., Burlington, N. J., as special representative.

Arnold Lenz, for several years manager of the Detroit Gray Iron Foundry Co., Detroit, has been named assistant to the general manager of the Saginaw Products Co., Saginaw, Mich. Harry D. Tunis succeeds him as manager of the Detroit company.

Clifford E. Pierce of the Betz-Pierce Co., Cleveland, iron and steel jobber, has been elected president of the Massillon Steel Castings Co., Massillon, O. He succeeds Emmet H. Birney who resigned recently to devote his time to his duties as vice president and general manager of the Union Drawn Steel Co., Beaver Falls. Pa. A. H. Anthony has been named vice president and general manager of the Massillon company.

Martin Balk now is connected with the Standard Brass Foundry Co., Grand Rapids, Mich. Mr. Balk has been engaged in foundry work for 20 years, having been coreroom superintendent for the last 7 years at the Campbell, Wyatt & Cannon Foundry Co., Muskegon, Mich.

How good is YOUR memory for faces?

C. R. Brown, purchasing agent for the Saco-Lowell Shops, Boston, for 38 years has resigned. He is succeeded by R. J. Courtenay of the purchasing staff of the Bethlehem Steel Corp., Bethlehem, Pa.

W. J. MacNeill recently was appointed superintendent of the Federal Malleable Co., West Allis, Wis.

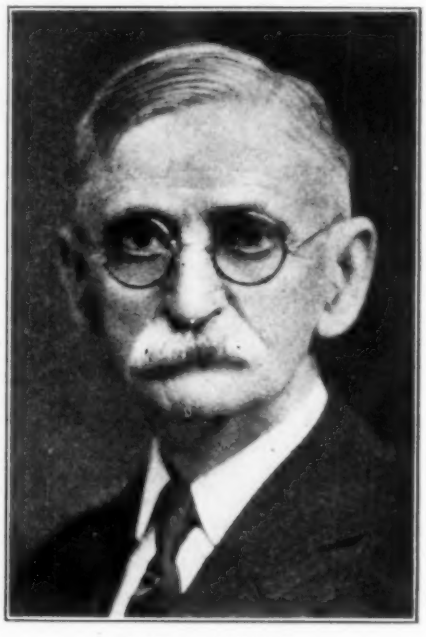
A playground in the western part of White Haven, Pa., has been named Wilmot Park in honor of George Wilmot, president of the Wilmot Engineering Co., the chief industry of the town.

Champions Cause of Purchasing Agent

THE Feb. 15, March 1 and March 15 issues of THE FOUNDRY *contained a series of articles challenging the tactics and business methods of the purchasing agents for firms buying castings.* THE FOUNDRY *has arranged for John C. Dinsmore, puchasing agent of the University of Chicago, to prepare three articles presenting the purchasing agent's point of view. The first article will appear in the July 15 issue. Mr. Dinsmore is secretary for the Purchasing Agents Association of Chicago, vice president of the National Association of Purchasing Agents, counsel of the department of purchasing practice for the Institute of American Meat Packers, editor of the standard text, "Purchasing Principles and Practice," editor of the University Purchasing Guide and editor of the Chicago Purchasing Agent.*

John Lavelle Sr. Dies

John Lavelle Sr., president of the Lavelle Foundry Co., Anderson, Ind., died May 27, aged 79 years. Mr. Lavelle organized a small jobbing foundry April 17, 1903, under the name of the Lavelle Foundry Co. This plant operated in a conservative manner from the start and was exceptionally successful. In 1915 the company started a program of expansion, another plant being built at Anderson. Two years later another plant was started and in 1919 plants Nos. 2 and 3 were consolidated. In 1920 the building for the plant at Argos, Ind. was acquired. The great-



JOHN LAVELLE

est achievement of the company was the errection of its plant at Indianapolis, of which Mr. Lavelle was justly proud.

Foundrymen Meet

R. R. Clarke, superintendent of the alloys foundry of the General Electric Co., Erie, Pa., addressed the Philadelphia Foundrymen's association at the Manufacturers club, that city, June 10, on the subject of "The Foundry Physicist." The meeting also was featured by a talk on sick benefits for foundry and machine shop workers. Barrows & Co., Inc., represented by R. E. Blazo, in charge of pig iron sales and Dr. C. E. Palmer, caster in gold, both of Philadelphia, have been elected members.

The Republic Flow Meters Co., Chicago, has opened a branch office at 535 Bramson building, Buffalo. W. W. Barron, formerly of the Chicago office, is in charge.

Foundrymen Meet in Scotland

Malleable and Perlitic Iron Discussed—Heat Treatment of Castings Considered —American Contribution on Sand Testing—Bronze and Aluminum Covered

BY VINCENT DELPORT
European Manager The Foundry

LARGE attendance of members from all parts of the country marked the twenty-second convention of the Institute of British Foundrymen held in the lecture hall of the Institution of Engineers and Shipbuilders of Scotland, Glasgow, June 10 to 12. The social features of the occasion were attended to adequately and the plants visited were of unusual interest. In addition to the papers presented by members of the association, the annual exchange paper of the American Foundrymen's association was read; also a paper from the Association Technique de Fonderie de France, whose president E. Ramas also sent a telegram of greeting and felicitation.

At a general council meeting held on the day preceding the general congress a committee on international relations was appointed including V. C. Faulkner, editor *Foundry Trade Journal;* Wesley Lambert, J. Stone & Co.; Vincent Delport, European manager, THE FOUNDRY. The special duty of this committee is to take charge of the arrangements for the international foundry convention scheduled for next year in the United States.

At the first session Wednesday morning the Oliver Stubbs gold medal was awarded professor A. Campion, Glasgow, for meritorious service rendered the foundry industry. At the same session the president, R. O. Patterson on behalf of the institute presented Oliver Stubbs with an illuminated address in recognition of his valuable services during his two years of office as president and since that time. The new president, John Cameron, Cameron & Robertson, Kirkintilloch, Scotland and the other incoming officers whose names are shown in the accompanying box were elected and installed in office at this session.

A prolonged discussion followed the reading of a paper on *Low Temperature Heat Treatment of Special Cast Irons* by J. W. Donaldson, Scott's Shipbuilding & Engineering Co. Ltd., Greenock. Among the conclusions arrived at by the author are: Annealing cast iron for prolonged periods at temperatures of 450 and 550 degrees Cent., respectively, produces changes in the composition of the iron which affect the strength and hardness of the material. These changes are due to decomposition of the carbide and are more marked at the higher temperatures. If cast iron is to be subjected to high temperatures, its strength at these temperatures cannot be determined on test bars. Small additions of chromium have the most marked effects of any element on the properties of heat treated cast iron.

Foundrymen Elect

Officers for year 1925-26

President

John Cameron, Cameron & Robertson, Kirkintilloch, Scotland

Senior vice president

V. C. Faulkner, editor *The Foundry Trades Journal*, London.

Junior vice president

John T. Goodwin, vice chairman of the British cast Iron Research association, Chesterfield

Hon. Treasurer

F. W. Finch, 52 Denmark Road, Gloucester

General Secretary

William G. Hollinsworth, 38 Victoria street, London, S. W. 1

New members of the general council: W. T. Evans, East Midlands branch; A. Firth, Sheffield branch; J. Haigh, Lancashire branch; A. Harley, H. Winterton, Scottish branch

Do Not Coincide

The paper contributed by the Association Technique de Fonderie de France, *Heat Resisting Cast Iron* was prepared by Andre Levy, a member of the staff of the Foundry High school, Paris. The paper summarized the work done by preceding authors on the influence of temperature on cast iron and proposed certain analyses for various classes of castings. In the discussion which followed the opinion practically was unanimous that the proposed analyses would not meet British specifications.

Many interesting points on the subject of malleable iron were brought out in a paper presented by F. H. Hurren, Rover Motor Car Co., Coventry. He claimed that an investigation urgently is required on the production of pig iron suitable for the malleable trade. Research must be made into the effects of varying proportions of silicon and carbon on annealing properties.

Two papers were presented on the subject of nonferrous metals. One by Francis W. Rowe, research department, David Brown & Sons, Ltd., Huddersfield, on *The Application of Metallography in Bronze Founding.* The second paper was prepared by S. L. Archbutt, National Physical Laboratory, on *Aluminum Alloy Castings.*

At the second session A. Rhydderch, director, Robert Hyde & Son, Sheffield, read the American Foundrymen association exchange paper prepared by Dr. H. Ries, Cornell university, chairman of the sub committee on sand tests, joint committee on molding sand research, *The Present Status of the Laboratory Investigation of Sands.* The first part of this paper is published in this issue of THE FOUNDRY commencing on page 531.

One of the most interesting papers, dealing as it did with a somewhat controversial subject, was that presented by H. J. Young on *The Practice and Purpose of Perlit Iron.* The author claimed that perlit cast iron is the most important discovery made in the foundry in 50 years. He laid particular stress on the definition of perlit iron in contradistinction to perlitic cast iron. The paper covered the personal work and experiments of the author at the works of the North-Eastern Marine Engineering Co., in connection with introducing the perlit process in the foundries.

Make Cast Iron Pipe

The stockholders of the Compagnie Generale des Conduites d'Eau held their annual general meeting on May 19. The company is one of the leading manufacturers of cast iron pipe in Belgium with a capital of $990,000 and debentures amounting to $725,000. For over a year the plant has been using the process of centrifugal casting and after a period of adjustments now is obtaining satisfactory results. During 1924 the output of the works was 25 per cent in excess of the 1923 production and the present state of the order books justifies hope that the output for this year will be greater than at any time previously.

Reports Status of Sand Tests—I

(*Concluded from Page* 534)

ference of opinion as to what forces are operative in disrupting the sand, that is, whether they are tensile, compression, or shearing forces, or a combination of these; which one of these the bond test should measure, or whether they are so related to each other that any form or test which measures the strength of the bond may be used.

We have before us in the United States, three types of test, which have been recommended for determining the bonding strength of green sands, viz: 1. The bar test which has been standardized by the American Foundrymen's association, 2. a compression test, and 3. a tensile test. The last two are now under investigation by the subcommittee on tests.

The bar test involves compacting the green sand in a box mold under specified conditions, then removing the bar from the mold and drawing it over the edge of a plate at a given rate of speed. The weight of the piece breaking off varies directly as the strength of the sand. The breaking of the bar is due mainly to the operation of forces of tension, and with care it is possible to get average breaks which do not vary by more than 5 per cent as specified in the recommendations.

The test as a whole is satisfactory, and is being quite widely used in different foundries for control work. The apparatus requires more space than that used for the compression or tensile test, and when the sand is too dry there is considerable shearing in the bar, the true strength is not obtained.

For the compression test the sand is formed into a core, obtained by ramming it in a cylinder, broken in a suitable machine by compression. The results being expressed in pounds per square inch or some other unit. Several types of apparatus are being tried out in the United States, and all seem capable of giving good results if properly made. One point to be considered is the ratio of diameter to height of sand cylinder tested, for cylinders of the same sand in which the ratio of these two dimensions vary will not of course give the same compression strength per square inch.

A cylinder 2 inches high and 2 inches diameter yields a higher unit strength than one which is 1¾ inches high and 1⅛ inches diameter, the composition being the same. From the view point of mechanics of materials the latter may be more correctly proportioned, but from the standpoint of practicability the former is easier to make, because it can be molded in the rammer used for the permeability test, but even after it is an appropriate one for measuring the bonding strength of the sand. There seems no doubt that the chief factor which helps the sand to resist a compressive force is the bond surrounding the grains of sand, and hence it is assumed by some at least we are really measuring the bonding strength.

Don't miss pages 564 and 565 The Foundry, July 15.

Discusses Adoption of Test Bar

Walter Wood, R. D. Wood & Co., Philadelphia, has been making an extensive trip in Great Britain and on the Continent. Mr. Wood talked with a number of representatives of foundrymen's association in Great Britain, France, Belgium, Germany and Switzerland with the object of securing the adoption of an international test bar. In an interview with a representative of THE FOUNDRY in London, Mr. Wood stated that he thought at present most of the representatives in Europe were willing practically to accept the American standard test bars to have a range for various thicknesses of castings. Mr. Wood stated that the American bar is to apply only to the metal in the ladle and not to the casting. He seemed to agree with the French theory that the test bar must be taken from the casting itself to obtain information on the casting. He added this could be done if the Fermont machine for testing bars is satisfactory, but that this is a different proposition from the standard bar which is being involved by American foundrymen.

Mr. Wood also talked with a representative of a syndicate in Germany on cast iron pipe specifications, and stated that this syndicate had agreed to some international specifications dealing with such points as thickness, weights, etc. He suggested that after the Germans fully decide on the matter, they secure the co-operation of the French and then Great Britain. After European foundrymen have agreed on the subject, the matter should be discussed with the foundrymen in America.

Consider White Heart Malleable Castings

An interesting paper dealing with the peeling of white heart malleable castings was read at a meeting of the British Iron and Steel Institute held in London, May 8. The paper was prepared by Douglas H. Ingall, head of the County Technical college, Wednesbury, and H. Field, Harper & Son, Willenhall.

The paper discussed the defects caused by peeling which is detrimental to good malleable castings and becomes of vital importance to founders and machinists. Such castings while apparently normal reveal on fracture one or more layers of *skin* or *peel* which are brittle when subjected to strain.

Prof. Thomas Turner, University of Birmingham, England, in discussing the subject stated that the rate of heating when annealing the castings has a great influence on the peeling, even if the cast iron originally is of a suitable composition. If the annealing temperature is too high, the casting may show characteristic peeling. One of the advantages possessed by American makers of malleable is the low proportion of sulphur in the pig iron used while English makers use iron containing as high as 0.35 per cent of sulphur. It has been shown that sulphur within ordinary limits has no detrimental effect on the mechanical properties of white heart malleable which probably explains why English foundries continued to use it. Professor Turner's own researches show that when the silicon is high in the casting there is a greater liability to peeling and that the acceleration of peeling due to the sulphide of iron being mobile and therefore more readily oxidized at the temperature where peeling results.

Dr. Hatfield, Sheffield, considers that high silicon at a high temperature is largely responsible for the peeling, and the sulphur is higher in all European malleable castings than is found in the American *black heart* variety. Dr. Hatfield further stated that it is true that up to 20 or 30 years ago irons containing 0.30 per cent sulphur were the only materials available for malleable casting and the difficulty was that if iron was low in silicon it was high in sulphur.

Professor Campbell, Columbia university, New York, suggested that the rate of oxidation depends upon the amount of manganese present. Iron containing iron sulphide when heated changes its structure and becomes

a ternary eutectic of iron, iron oxide and iron sulphide. The higher the manganese, the slower the change takes place. Dr. Rosenhain stated that the position of malleable iron manufacturers has been aided by the cheap methods now available for removing the sulphur from the pig iron.

H. Field, one of the authors, replying to the discussion, stated that part of the trouble of the English malleable manufacturer is due to melting the iron in a cupola furnace, while in America the melting is carried on in an air furnace.

Elect General Manager

Stockholders of the Diebold Safe & Lock Co., Canton, O., have re-elected Charles C. Upham president and general manager, A. J. Roos first vice president and treasurer, H. C. Weible secretary, J. L. Criswell vice president and general manager of sales, J. A. Fellows vice president in charge of burglar-proof sales and H. A. Noble vice president in charge of fireproof sales.

Establish Branch Offices

The American Appraisal Co., Milwaukee, has established two new branch offices in the Southwest. L. B. Jones has been placed in charge of the Dallas, Tex., office at 612 Mercantile Bank building, and John F. Wood has been made manager of the Kansas City branch at the Pioneer Trust building, Kansas City, Mo

Officers Are Elected

F. R. Fishback has been chosen president of the Electric Controller & Mfg. Co., Cleveland, builder of industrial electrical equipment. Mr. Fishback formerly was vice president and secretary. He has succeeded H. F. Stratton, who retired from active business recently. D. C. Clark, treasurer and vice president, also has retired. He has been succeeded as vice president by R. G. Widdows, who also continues as sales manager. G. R. Simons, former assistant treasurer, has become treasurer. D. C. Wright, chief engineer, has been named secretary and chief engineer.

Norton Awarded Medal

Charles H. Norton, consulting engineer, the Norton Co., Worcester, Mass., was awarded the John Scott medal at the commencement exercises of the University of Pennsylvania, June 17. The John Scott medal is awarded for exceptionally notable achievements in the field of mechanical arts, the award in this case being for the invention of accurate grinding devices of high power. Mr. Norton's inventions include the shape of the table, the mounting of the head and foot stocks, the mounting of the wheel slide and feed screw, the construction of a wheel slide without an adjustable gib, the micrometer cross feed for the wheel slide, etc. Mr. Norton has invented and designed many special machines for putting his ideas into practice.

A Correction

In a paper prepared by R. A. Bull for the American Society of Mechanical Engineers, a proof error gave the tonnage of open hearth castings produced in the United States in 1917 as 357,700. This should have been 1,357,700 net tons.

Hold Annual Outing

The annual outing of the Pittsburgh Foundrymen's association was held at "The Pines" near Pittsburgh, Monday afternoon and evening, June 22. A ball game between the foundrymen and supply men and other sport events were staged simultaneously. Prizes were awarded.

Milestones in Foundry Progress

(*Concluded from Page* 541)

These included malleable castings, sampling pig and cast iron for export, foundry coke and government bronze.

* * *

Thomas D. West presented an illustrated article on intoxication as a case of accidents in foundries. Mr. West's death in an automobile accident was recorded in the same issue.

* * *

H. J. McMurtrie conducted some investigations on melting losses in the cupola and found that pig iron lost about 4.75; cleaned new stove plate, 7.95; purchased stove plate, 11.35; and new stove plate with the sand and sprues adhering, 14.00 per cent in melting.

* * *

Which revives that old discussion of sand cast vs. machine cast pig iron.

* * *

John C. Haswell, Marion, Ind., was elected president of the Dayton Malleable Iron Co. New additions were started at the Dayton plant.

* * *

Jordan L. Mott Co., Trenton, was making additions to its plant to produce war materials.

Bucket Inventor Dies

John H. Hayward, founder of the Hayward Co., New York, died June 14 at Teaneck, N. Y., aged 78. After graduation from a military academy, he took a position in the Manhattan Savings Institution and later went into the produce business as a member of the New York Produce Exchange. About 52 years ago he moved to Staten Island, where he met Dr. Johnson, an inventor. Their friendship rapidly grew, the outcome being an automatic bucket. Later the Manhattan Dredging & Elevating Co. was organized to do general contracting, Mr. Hayward being general manager. Later he took up the building of buckets. The first bucket was known as an orange peel and was built in a shop located on Washington street, New York.

At the time of his death Mr. Hayward was vice president and treasurer of the Hayward Co. He was a member of the Engineers' club, Machinery club, being a governor in the latter organization.

Obituary

C. H. Waterous, president of the Waterous Engine Works Brantford, Ont., died on June 10. He was prominent in the industrial and public life of the city, having been mayor.

Alfred E. Wells, director, Edgar Allen & Co. Ltd., Sheffield, England, died recently. Mr. Wells who was an important official with the Allen company and who was prominent in the development of manganese steel was an outstanding figure in the British foundry industry. His death was due indirectly to injuries which he received in an automobile accident several years ago.

Josiah Mentor Gimson, a well-known foundryman of Leicester, died recently at his home in Birmingham, England, aged 73 years. He was chairman of Gimson & Co., Ltd., iron founders, the Gimson Shoe Machinery Co., Ltd., the Leicester Navigation Co. Ltd., the Leicester Secular Hall Co. Ltd. and formerly was chairman of the Leicester Coal Consumers Co. Ltd. Mr. Gimson was also a member of the executive board of the Engineering Employers' federation. At one time he was president of the Institute of British Foundrymen.

John A. Abele has been appointed district sales manager by the Industrial Works, Bay City, Mich., of the new district sales office, 425 Whitney Central Bldg., New Orleans.

Equipment Buying Slackens

Hot Weather and Vacations Have Tendency To Hold Up Orders— Department of Commerce Report Shows Sales of Equipment Fall in April

VACATIONS and seasonal conditions have combined to cause a slight slackening in sales of foundry equipment throughout the various distributing centers of the country. Inquiries are not as plentiful and interest is somewhat lacking in lists that previously have been brought out. Buyers, with some rare exceptions, are hesitating, as they have been for some weeks, placing orders for equipment only as absolutely needed. However, many manufacturers feel that this slackening may be expected during this period of the year, but look to the reported slight increases in operating capacities of foundries to be reflected in buying of equipment. The movement of supplies is satisfactory.

Unfilled orders for foundry equipment on May 1, as reported to the department of commerce, show a total value of $539,232, which practically is the same as the value of $539,952 reported on April 1. April sales totaled $345,908 in value as compared with sales in March valued at $469,325. Shipments in April reached a total value of $325,952, as compared with March shipments with a value of $348,590.

Inquiries Fail To Hold Former Pace

MANUFACTURERS of foundry equipment in the Chicago district are finding both inquiry and selling feeling the effects of the mid-summer letdown. The Beardsley & Piper Co., Chicago, has sold sand throwing machines of the tractor type to the International Harvester Co., Chicago; Pratt & Letchworth Co., Buffalo; Walworth Mfg. Co., Boston; Standard Foundry Co., Buffalo; Holmes Foundry Co., Port Huron, Mich.; Muncie Foundry & Machine Co., Muncie, Ind., and Symington Corp., Rochester, N. Y. It has placed two of its stationary type machines in the plant of the Standard Sanitary Mfg. Co., Baltimore, and one each in the Nash Motors Co., Kenosha, Wis., and the John Deere Plow Works, East Moline, Ill. One each of the portable type has been taken by the Studebaker Corp., South Bend, Ind., Greenlee Foundry Co., Chicago, and the Penfield Foundries, Pittsburgh. The Atlas Steel Co., Buffalo, and the Gould Mfg. Co., Seneca Falls, N. Y., have purchased locomotive type machines. The National Engineering Co., Chicago, has sold sandmixers to the Kennedy Valve Mfg. Co., Elmira, N. Y.; Kohler Co., Kohler, Wis., and Sterling Foundry Co., Wellington, O. The Hall Scott Motor Co., Oakland, Calif., has purchased sand-blast and dust arrester equipment and the Marion Malleable Iron Works, Marion, Ind., the Campbell Wyant & Cannon Mfg. Co., Muskegon, Mich., and the Clinton Lock Co., Clinton, Ia., have purchased sand-blast equipment from the Pangborn Corp., Hagerstown, Md. Little in the way of new construction is developing.

New England Equipment Dull

WHILE molding machine sales have shown some improvement in New England recently, the equipment market continues dull. As part of an extensive building program the Draper Corp., Hopedale, Mass., bought a 20-ton cupola from the J. W. Paxson Co., Philadelphia. A Connecticut foundry is receiving bids on a 10-ton cupola. Another Connecticut foundry is in the market for an annealing oven. The Plainville Castings Co., Westfield, Mass., has purchased sand-blast equipment from the Pangborn Corp., Hagerstown, Md.

Pittsburgh Buying Curtailed

OPERATIONS among foundries still are upon a comparatively low scale, in some cases not being much above 50 per cent and equipment purchases accordingly are much curtailed in the Pittsburgh territory. Occasionally some orders develop which give the market a semblance of activity. The movement of smaller supplies is splendid and if the market runs true to form this points to early buying of the heavier lines. Various sized lots of riddles, cupola charging cans, flasks, shovels, wheelbarrows, cupolas, vibrators, etc., are ordered each week. Contracts for cupolas recently taken by the Whiting Corp., Harvey, Ill., include one for the Chisholm & Moore Mfg. Co., Cleveland; one for the Oil City Iron Works, Shreveport, La., together with a 1-ton converter; one for Box Bros., New York, and one for the Pittsburgh Lamp Brass & Glass Co., Pittsburgh. The Zelienople, Pa., foundry operator which has been negotiating for a cupola may not buy for four or five months. The National Tube Co., Lorain, O., has the matter of its core shakeout equipment lined up ready for early action. The Vulcan Mould & Foundry Co., Latrobe, Pa., which will install an electric furnace in the Peerless Foundry Co. which it recently leased, has purchased a 10-ton helical worm-geared ladle from the Whiting Corp. The latter interest also sold a tumbling barrel to the Fay Foundry Co., St. Joseph, Mich., and a contract for six of these units was placed by the Crompton & Knowles Loom Works, Wooster, Mass. At least three local foundry interests are prospective purchasers of brass furnaces. More inquiries are coming out each week for molding machines and additional orders are being placed. The Massillon Steel Casting Co., Massillon, O., bought four and the American Radiator Co., Buffalo, N. Y., and the International Heater Co., Utica, N. Y., each bought two, while the Chicago Scale Co., Chicago, ordered one. The J. S. McCormick Co., Pittsburgh has sold a number of hoists to the United States government for use on battleships at Puget Sound, Washington. It also sold a sand separator to the United States Sanitary Mfg. Co., Monaca, Pa., and several ladles to different local and nearby foundries. The Bessemer Gas Engine Co., Grove City, Pa., is under-

stood to have been a recent purchaser of some small foundry equipment and will also buy two or three cranes. Crane buying by foundries still is spasmodic. The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., bought a 5-ton, 40 foot span electric traveling crane for its Cleveland plant from the Whiting Corp., which also sold a number of hand-power cranes to the Honolulu Iron Works, New York City, apparently for export.

Eastern Buying Sluggish

FOUNDRY equipment buying in the New York district continues sluggish. Jobbing foundry operations average between 30 and 40 per cent, and under such circumstances foundrymen are showing little disposition to buy. The past two weeks have been slower if anything than the preceding fortnight, seasonal influences having a bearing. Among scattered orders are a 49-inch cupola for a new foundry, as yet unnamed, at Royersford, Pa., and sand blast equipment for the Eagan Rogers Co., Crumlynn, Pa., and for the Geneva Foundry Co., Geneva, N. Y., this business all going to the J. W. Paxson Co., Philadelphia. R. Hoe & Co., Dunellen, N. J., has purchased sand blast equipment in addition to that listed in the last report from the Pangborn Corp., Hagerstown, Md. A 1-ton handpower crane, 48-foot span, has been purchased by the Simon Scullin Foundry Co., Philadelphia, from Alfred Box & Co., Philadelphia. Little else in the way of conveying equipment business is noted. The Florence Pipe, Foundry & Machine Co., Florence, N. J., is expected to close shortly on the remainder of its equipment, including five overhead cranes, the president of the company having recently returned from abroad. A prospective buyer is the Lycoming Foundry Co., Williamsport, Pa., which is expected to start work shortly on an 80 x 200-foot addition; another is the Flynn & Emerick Co., Baltimore, with $50,000 extensions, including a foundry. Several smaller projects are noted.

Cleveland Market Quiet

QUIETNESS characterizes the market for foundry equipment in the Cleveland territory. Inquiries have fallen slightly and a greater amount of hesitancy is being encountered in securing orders for equipment on which quotations previously were made. Men of the trade feel that the greater portion of slackening probably is due to the extreme hot weather and to the fact that the vacation season now is on. The Peninsular Stove Co., Detroit, has purchased a small sand machine from the Standard Sand & Machine Co., Cleveland. Shakeout bails have been purchased by the Ford Motor Co., Detroit, the Ferro Machine & Foundry Co., Cleveland, the Waterloo Gasoline Engine Co., Waterloo, Ia., and the Thatcher Co., Newark, N. J., and vibrator and shakeout equipment by the Marshall Furnace Co., Marshall, Mich., and the International Heater Co., Utica, N. Y., from the Stoney Foundry Engineering & Equipment Co., Cleveland. The Industrial Steel Casting Co., Toledo, O., has secured sand blast and dust arrester equipment and the Atlas Foundry Co., Detroit, has purchased sand blast equipment from the Pangborn Corp., Hagerstown, Md. L. Schreiber & Sons Co., Cincinnati, the Erie Stove Co., Erie, Pa., the Central Foundry Co., Ft. Wayne, Ind. and the Stockham Pipe & Fittings Co., Birmingham, have purchased tumbling mills from the W. W. Sly Mfg. Co., Cleveland, while the National Malleable Castings Co., Cleveland, the American Foundry Co., Indianapolis, Ind., have purchased sand-blast and dust arrester equipment and the Saginaw Malleable Iron Co., Saginaw, Mich., and the Muskegon Malleable Castings Co., Muskegon, Mich., have secured sand-blast mills from the W. W. Sly Mfg. Co., Cleveland.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Fire slightly damaged the Laconia Car Co., Laconia, N. H., lant recently.

The plant of the Standard Machine Co., Owosso, Mich., recently damaged by fire, is being reconstructed.

Pacific Stove & Foundry Co., Seattle, has been incorporated for $35,000 by Theodore Eggers, W. H. Mackey and L. B. MacDonald.

Model Brass Works, Decatur, Ill., will erect a 60x80-foot plant for production of brass, bronze and aluminum castings.

Nash Motors Co., Kenosha, Wis., has awarded contracts for constructing a manufacturing plant here, to Worden-Allen Co.

Hammond Brass Works, Hammond, Ind., plans rebuilding its plant which was damaged by fire Decoration Day. *Noted June* 15.

Ohio Brass Co., Mansfield, O., plans constructing third story to its present plant on Surry road. L. Olson is superintendent.

Everett Winters Co., Detroit, has awarded subcontracts on the construction of a plant for the Unique Brass Foundry, 123 Military, Detroit.

Rebuilding of the fire damaged plant of the Beloit Foundry Co., Beloit, Wis., is being contemplated. The company made gray iron castings.

Huntley Mfg. Co., Silver Creek, N. Y., manufacturer of flour mill machinery, plans purchase of a site for constructing a new plant to increase capacity.

A $52,000 plant, 90 x 360 feet, will be erected by the Flynn & Emerich Co., 305 N. Holiday street, Baltimore. The plant will include a foundry, machine shop and storage building.

Dennison Alloy & Steel Casting Co., Dennison, O., has started remodeling the plant it will use for its foundry. New equipment is to be purchased. Donald S. Jones is superintendent. *Noted April* 15.

General Die Castings Co., Benton Harbor, Mich., has been incorporated for $60,000 to manufacture all kinds of dies and castings, by Alfred E. Croft, H. S. Gray and R. C. Eisley. *Noted June* 1.

The Alchrome Bearing & Castings Corp., Cheshire, Conn., has been formed with $50,000 capital by Henry M. Bentley, Robert McCullock, and Charles F. Mitchell, all of New Haven, Conn.

Horn & Brannen Mfg. Co., 427 North Broad street, Philadelphia, has obtained property at 441 North Broad street for a larger works. The company manufactures illuminating fixtures.

Remington Typewriter Corp., 374 Broadway New York, plans constructing a 4-story addition to its plant at Ilion, N. Y. Kinne & Frank, 7 Hopper street, Utica, N. Y., are architects and engineers.

Flynn & Emrich Co., 305 North Holliday street, Baltimore, manufacturer of stokers and general machine shop, plans constructing 1-story, foundry, machine shop, and storage building and steam power house.

Connor Foundry Co., Grand Rapids, Mich., has been incorporated with an authorized capital stock of $50,000. Neil Kunst, 545 Fairview avenue, N. E., is president and general manager. Thurlow E. McFall, and Tunis Johnson also are interested.

Lansing Metal Products Co., Lansing, Mich., has been incorporated with $25,000 capital to own and operate a foundry and machine shop by Earle R. Pitt, North Holt, Mich., Harry Norris and Frederick A. Van Fleet, 216 West Hillsdale street, Lansing.

Grenloch Foundry & Machine Co., Grenloch, N. J., has been incorporated for $25,000 to operate a foundry, by John R. Grisinger, Thomas W. Loring, Grenloch, and John A. Deaner, Turnerville. George B. Marshall, Woodbury, is attorney.

Detroit Aluminum & Brass Corp., Detroit, has taken over the plant of the Graham Bros. Co. at Conant road and Christopher street and will manufacture castings, motor

bearings, etc. J. P. Carrittee, formerly head of the McAdamite Aluminum Co. is president and treasurer. L. G. Hooker, vice president and secretary formerly was treasurer of the General Aluminum & Brass Mfg. Co. *Noted June* 1.

Southern Metallic Products Co., Oklahoma City, Okla., has started operations at 1200 South Agnew avenue. The company makes aluminum, brass, copper and iron castings. Executive offices are at 611 Grain Exchange building.

H. Wetter Mfg. Co., Gladsen, Ala., has let the contract for the building of a main plant 125x600 feet costing 100,000 with a 60x80 foot cupola building attached. Smaller buildings for pattern shops and machine shops will be built later.

Burns Brass Foundry, Battle Creek, Mich., Fred E. Flanders, president, and L. H. Skinner, secretary and treasurer, has nearly completed its new plant which will nearly triple the present capacity. The new location is more convenient to shipping facilities also. *Noted April* 1.

The Griffin Wheel Co., subsidiary of the American Steel Foundries, Chicago, will erect a plant, including a cupola, powerhouse, foundry and machine shop under one roof, on a plot of six and a half acres at Salt Lake City . The plant will be ready for Sepration by the first of next year.

New Trade Publications

CENTRIFUGAL PUMPS—The Pennsylvania Pump & Compressor Co., Easton, Pa., has issued a folder describing the various parts of a centrifugal pump of its manufacture.

FLASKS—Aluminum taper snap flasks are described and illustrated in a folder of the American Foundry Equipment Co., New York. Steel pouring jackets also are listed.

LIFT TRUCK PLATFORMS—A bulletin by the Lewis-Shepard Platform Corp. Boston, features its steel leg lift platforms, all-steel box type platforms and other devices for convenient handling of materials.

REFRACTORIES—A refractory fire brick for severe conditions, fusing around 3400 degrees and adapted for metallurgical use is featured in a leaflet by the Ashland Fire Brick Co., Ashland, Ky.

INDUSTRIAL LIGHT—The Alexander Melburn Co., Baltimore, has issued a booklet describing a method of illumination which may be used for various industrial purposes where a portable light is necessary.

ARC WELDER—Northwestern Mfg. Co., Milwaukee, has issued a bulletin describing its arc welder in which stabilization of the current is attained by internal means, giving a steady arc. Diagrams illustrate the wiring and arrangement of the welder.

WELDING—An electric arc welded structural steel building erected by the Chicago, Burlington & Quincy railroad at Eola, Ill., is described in a booklet recently issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PLATE VALVES—Automatic plate valves for blowing engines and compressors, as well as other uses, are featured in detail in a bulletin by the Mesta Machine Co., Pittsburgh, drawings of the valves and installations in which they are used being used as illustrations.

RUST PROOFING—Chemical conversion of the surfaces of iron and steel to basic iron phosphates, insoluble in water and permanent in air is the process employed by the Parker Rust-Proof Co., Detroit, described in a catalog put out by that company.

TWIST DRILLS—A new catalog is being issued by the Cleveland Twist Drill Co., Cleveland, in which are contained some new types of drills. A new section of mechanical data is presented, carrying much useful information for the shop man.

SPECIAL ALUMINUM ALLOYS—Aluminum castings of various degrees of hardness for varied purposes are described in a bulletin by the Permold Co., Cleveland. Several characteristic alloys are presented in detail and others suggested for special uses.

SAND AND GRAVEL HANDLING EQUIPMENT—Link-Belt Co., Chicago, is distributing a 72-page book describing and illustrating various types of screening, washing and handling equipment used in the preparation of sand and gravel.

PUMPS—Air lift pumps are described in a bulletin of the Pennsylvania Pump & Compressor Co., Easton, Pa. The lift system is described and illustrated and various tables and figures are given including the formula for calculating the horsepower required to pump water.

ASH HOISTS—Equipment for handling and hoisting ashes as well as other heating plant handling equipment is described in a booklet recently issued by Herbert Morris Inc., Buffalo. The publication is well illustrated with reproductions of photographs of the equipment in operation.

FIRE OBSERVER—A device to allow inspection of the interior of a furnace is shown in a bulletin by the Vastine Sales Corp., Chicago. Comfort to the inspector is claimed and no cold air is allowed to enter the furnace. Application to various types of furnaces is shown.

ARC WELDING—A resume of the uses and value of automatic arc welding and a description of apparatus and generating equipment are given in a bulletin by the General Electric Co., entitled Automatic Arc Welding. It contains 20 pages and is illustrated by halftones of equipment and actual applications.

FLUX—The Mathieson Alkali Works, Inc., New York, has published a booklet describing a cupola flux for cast iron. This flux comes in molded bricks of convenient size weighing about two pounds each, and it is claimed can be handled with bare hands. The fluxing of a cupola is described in the publication.

HANDLING EQUIPMENT—The material made for the iron and steel industry by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., is described in a recent publication of that company. The material in the book is arranged to give the reader a clear conception of the various types of machines that may be applied to the industry.

WELDING TORCHES—An automatic shut-off welding torch is described in a folder of the Bastian-Blessing Co., Chicago. The torch has a trigger for turning off the gas and is so arranged that once the torch is adjusted, it may be turned off and relighted at will without affecting the gas mixture. These torches may be had separately or in complete outfits.

NONFERROUS ALLOYS—The Niagara Falls Smelting & Refining Corp., Buffalo, N. Y., has issued a series of folders describing alloys and giving the composition. The list includes bearing bronze, manganese bronze, manganese copper, rolling mill babbitt, aluminum solder, phosphor copper, babbitt, ferro, aluminum, copper aluminum, etc.

BLOWERS—A 4-page phamphlet published by the Connersville Blower Co., Connersville, Ind., describes rotary blowers for flotation processes, aeration and agitation of chemicals, oils, water and other liquids. In addition to describing the different features of the units, the phamphlet gives specifications for various capacities and pressures.

CRANES—Mounting a full revolving crane on a truck chassis or caterpillar crawler gives access to almost any position where material is to be moved. Orton & Steinbrenner Co., Chicago, has isued a bulletin illustrating such devices and their uses, indicating the wide variety of uses to which they can be applied. Full specifications and clearance diagrams are included.

MATERIAL HANDLING EQUIPMENT—Electric storage battery industrial trucks, tractors and cranes are presented fully in a catalog by the Elwell-Parker Electric Co., Cleveland. Haulage in the plant is given careful discussion and the company's devices to make this effective and economical are described. Portable cranes are also described and illustrated.

INDUSTRIAL MOTORS—Use of motors on metal-working machines is described in a booklet by Fairbanks, Morse & Co., Chicago. Strenuous demands on motors operating modern, high-speed machines have brought about improvements in motors until they have been effected to a point where they handle the most difficult tasks. New applications and uses are described.

RECORDING THERMOMETERS—Catalog No. 1303 just published by the Bristol Co., Waterbury, Conn., discusses gas filled thermometers for temperatures between 60 degrees below zero and 1000 degrees Fahr. The book, which is illustrated, shows the variety of scale ranges and mechanical fittings which make the thermometers adaptable for wide uses in industrial plants.

SPECIAL MACHINERY—Dodge Mfg. Co., Mishawake, Ind., manufacturer of special machinery, has issued a handsome catalog, to carry the message of its facilities and accomplishments. A brief and condensed statement of its field constitutes the only printed text the remainder of the pages are devoted to halftone illustrations of unusual type and effectiveness which tell the story better than words.

AIR AND GAS SCRUBBER—To acquaint industry in a general way with the possibilities of savings and of improvements in conditions through the use of the air and gas scrubber is the purpose of bulletin No. 303 of the D. J. Murray Mfg. Co., Wausau, Wis. Besides describing the operation of the scrubber, the bulletin shows by sketches and text matter typical applications of the equipment to various industries.

ELECTRIC HEAT—To show the applications of electric heat to industrial processes, the General Electric Co., Schenectady, N. Y., has published bulletin Y-1866, listing representative installations of electrical heating equipment. Each application, such as baking, melting, annealing, tempering, carburizing, is listed separately. Additional information includes the name of the company using the installation, the process, size of apparatus, type of equipment and power rating. Many of the installations are for treating iron and steel and nonferrous metals.

The FOUNDRY

SELLING THE OUTPUT

The FOUNDRY

What The Industry Needs Today Is Sales Not Production

One Solitary Sour Fife Spoils the SWEETEST SYMPHONY

P. T. Barnum Says/

DO all you can for yourselves, and then trust to Providence, or luck, or whatever you please to call it for the rest.

WE ALL remember the story of the drunk at the orchestra concert who arose from his seat and called the piccolo player a name which I can't print, because we haven't that kind of type. The music stopped and the manager stepped out to inquire who had insulted the piccolo player. No response. Repeated demands and finally in desperation, the manager announced that the concert could not go on until the culprit was turned out. "I want to know," said he, "who called this piccolo player a boob." Boob isn't the word, but it sounds somewhat like the invective. "And I'd like to know," said the drunk, rising with difficulty, "who called that boob a piccolo player."

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IT IS always thus in music, baseball or business. The fellow who plays a dischord, boots a grounder or violates the decencies and ethics of his vocation or profession, is as popular as a pebble in the beans. The general public drags forth its most choice terms of contempt and applies them with blistering heat to the one who thus spoils the efforts of his accompanists and ruins the pleasure or profit of those indirectly concerned. J. Newton Barnes, secretary-treasurer of the J. S. Schofield's Sons Co., Macon, Ga., collected a specimen of this pest from the foundry industry and impaled him on a sharp pin for the intellectual study of the Southern Metal Trades association at its meeting this spring.

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MR. BARNES says, "Two members of this association were selling to a common customer. The customer came to *A* and gave him a job on open account. *A* filled it and charged it according to his cost. The customer went to *B* and showed him *A's* invoice and *B* deliberately told him he could have cut $150 off on a $400 job." Doesn't it strike you that a man who would do such a trick would kick the crutch from under his crippled grandmother? In the first place if he thought he could make the job at the saving stated, he might have been justified in offering a bid on the next lot of castings to be made, but why deliberately assasinate the other fellow's price on a job already done? Personally, I doubt if any foundryman in these days could cut $150 off the cost of a $400 job. This piccolo player, *B*, probably was as ignorant of his true costs as Methusala was about germs. He probably operated on the principle that the other fellow knew his costs, always took a profit and therefore he could safely knock off 37 per cent and not loose *much* money. Furthermore, if I belonged to the same association and ever got caught in a game of golf with him, he would have to tell his score first.

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A NUMBER of other points on mutual relationships were developed by Mr. Barnes, who defines the question as one of co-ordination rather than co-operation. He is right in that distinction, for the best co-operator is lost unless his efforts fit in with those of his fellows. Perhaps we are over organized so far as associations and societies go, but I do believe that the greatest benefits are secured by working actively in the business organizations which best serve the industry in which we all are interested.

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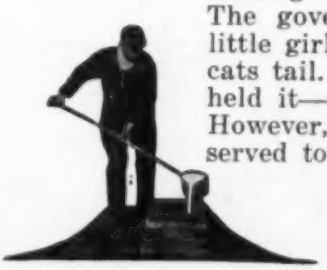
BUSINESS associations have been obliged to walk a thin chalk line due to uncertainty about the attitude of the government. In the past it has been necessary to establish the status of certain activities by first trying them and then waiting to see what happened. The government acted like the little girl accused of pulling the cats tail. She didn't pull it, she held it—the cat did the pulling. However, recent decisions have served to clarify the atmosphere.



Phineas, Jr